

HORTICULTURAL ABSTRACTS.

VOL. VI.

JUNE, 1936.

No. 2.

Abstracts. Initialled abstracts in the present number are by T. N. Hoblyn and H. M. Tydeman.

INDEX OF CONTENTS.

HORTICULTURE—MISCELLANEOUS	Nos. 242-255
TREE FRUITS, DECIDUOUS	256-283
General	256-257
Propagation	258-259
Rootstocks	260-265
Rootgrowth	266
Pollination	267
Growth, nutrition, etc.	268-275
Manuring, cultural practice	276-283
SMALL FRUITS, VINES, NUTS	284-289
PLANT PROTECTION OF DECIDUOUS FRUITS	290-326
VEGETABLE GROWING	327-352
FLOWER GROWING	353-358
CITRUS AND SUB-TROPICALS	359-371
TROPICAL CROPS	372-404
STORAGE	405-407
PACKING, PROCESSING AND FRUIT PRODUCTS	408-419
NOTES ON REPORTS	420-423

Horticultural Abstracts

Vol. VI

June, 1936

No. 2

HORTICULTURE—MISCELLANEOUS.

242. AKENHEAD, D. 659.25 : 634
Empire co-operation in scientific research. East Malling, the fruit centre.
Fruitgrower, 1936, 81 : 417-8.

A note on the function, staff, methods and work of the Imperial Bureau of Fruit Production, wherein is indicated how horticulturists can best profit by its existence.

243. RICHARDS, A. E. 63 : 334
Farmers' business organizations in Canada 1935.
Publ. Canad. Dep. Agric., 481, being *Tech. Bull.* 3, 1935, pp. 55.

This report summarizes the business activities of farmers' co-operative associations during the crop years 1932 and 1933. It supplements and brings up to date the results published in Bulletin 173 (n.s.). The information appears to cover all agricultural products, including fruit and vegetables, which are dealt with under one heading. 102 fruit co-operative societies, with a combined membership of 8,875 growers, market a large proportion of the Canadian fruit and vegetable crop. The business transactions and the scope of these associations are summarized under the various provinces concerned, namely British Columbia, Ontario, Quebec, Nova Scotia, and Prince Edward Island.

244. CAHAN, J. F. 634.1/8 : 382.5
Fruit consumption—the importance of imports.
Fm. Econ., 1932, 2 : 15-7.

The increasing quantities of fruit imported into Great Britain during recent years have not so far forced the British fruit grower to accept lower prices for his products, because the total demand for fruit has increased in proportion to the total supply. In time, however, the demand may become stationary, and the home producer will then feel the full force of competition from abroad. The price received for fruit may not fall below present levels, but will probably be lower relative to an increased level of incomes. Continued change in the taste of British consumers from home-grown fruits to such fruits as oranges and bananas, which have to be imported, will, if unchecked, tend to depress prices of British fruits still further.

245. PAULSON, W. E. 635.1/7 : 635.8
Co-operative vegetable marketing associations of the Lower Rio Grande Valley.
Circ. Tex. agric. Exp. Sta. 74, 1935, pp. 22.

Since 1911 when the first association to market vegetables came into being in the Lower Rio Grande Valley, the co-operative movement in that area has been subjected to numerous vicissitudes. Societies were founded and terminated at fairly regular intervals. The author traces their history and summarizes their experiences in the hope that they may prove helpful to growers of to-day who may be concerned in co-operative marketing.

246. DAWE, C. V., AND BLUNDELL, J. E. 634.973.623

An economic survey of the Somerset willow growing industry.

J. Bath W. S. Co. Ass., 1935-6, 10 (ser. 6) : 108-23.

The industry in Somerset is very localized, being confined to a few "moors" between Bridgewater and Highbridge, the total acreage under willows being about 1,570. The first plantings were made about 120 years ago, but the industry never really thrived until wicker chairs became fashionable and factories were established close at hand. The peak of prosperity was reached at the end of the war in 1918, when the price per bolt reached 27s. Then set in a general decline and to-day's price per bolt is 4s. 6d. Methods of cultivation are described and the costings worked out in detail. The outlook is not hopeful. Even if all stocks are cleared, which is often far from being the case, a grower with 5 acres must attend to at least 3 acres himself if he is to earn 30s. 6d. a week. With less than 3 acres he cannot earn a living wage. The solution does not lie in increasing the acreage. In the first place the grower would have to raise £170 additional capital for an increase of 5 acres, an insuperable problem to a man earning only £79 6s. per annum by dint of very hard work, and in the second place any great extension would certainly lead to a yet further fall in prices. If the situation is to be dealt with at all, it must be approached from the point of view of income and not from that of profit on costs.

247. EMPIRE FORESTRY CONFERENCE, SOUTH AFRICA, 1935. 631.459

Forests in relation to climate, water conservation and erosion.

Bull. Dep. Agric. S. Afr. 159 (Forestry Series No. 3), 1935, pp. 62.

The title of this bulletin formed the subject of enquiry by a special committee, whose report is here published under five main headings:—1. Forests and climate. 2. Forests and water conservation. 3. Erosion. 4. Veld-burning. 5. Conclusions. In addition the bulletin contains four annexures to this report under the following headings:—1. Verbatim report of Conference debate on forests in relation to climate, water conservation and erosion. 2. Memorandum by Mr. A. D. Lewis, Director of Irrigation, on soil erosion. 3. Memorandum by Mr. A. D. Lewis on effect of afforestation on water conservation with special reference to South Africa. 4. Photographs. Three further annexures are not included in this bulletin.

248. COLLISON, R. C. 634.11-1.432

Lysimeter investigations. IV. Water movement, soil temperatures, and root activity under apple trees.

Tech. Bull. N.Y. St. agric. Exp. Sta. 237, 1935, pp. 31.

Part I, Nitrogen and water relations of crops in legume and non-legume rotations, Part II, Composition of rain water at Geneva, N.Y., for a 10-year period, and Part III, Mineral and water relations and final nitrogen balance in legume and non-legume crop rotations for a period of 16 years, were published as *technical bulletins* 166, 193 and 212 respectively. The major project described in the present paper has been a study of water movements in the soil under apple trees with different forms of orchard soil management, but attention has also been paid to the movement of soil nutrients, soil temperatures, and root activity. The results, which are of a preliminary nature, have been obtained through the use of a new Russian lysimeter equipment, and an attempt has been made to point out and discuss the undesirable as well as the desirable features of the methods employed.

249. YEAGER, A. F. 581.144.2

Root systems of certain trees and shrubs grown on prairie soils.

J. agric. Res., 1935, 51 : 1085-92, bibl. 21.

Data on the depth and spread of 31 species of trees and shrubs were collected at Fargo, North Dakota. The average rainfall in this area is 22.34", but for the past 15 years it has been only 17.78", and for the past 6 years 15.43". Observations made in Fargo clay soil showed that 97.3% of the roots were confined to the upper 4 feet of soil. The horizontal spread of the roots ranged from 0.4 to 2.1 times the height of the tree, depending upon the species. A similar examination of root systems in a Barnes loam soil, which is lighter and sandier, showed that

the depth of penetration and spread of roots in this soil were practically the same as in the heavy soil. The effect of an increased moisture supply, as found along the edge of a slough, was to make tree root systems spread less and penetrate deeper. This was most noticeable in trees which are not very resistant to drought, whereas some types which are naturally resistant have deep root systems regardless of moisture conditions.

250. BROWN, A. B. 581.143.27
Cambial activity in poplar with particular reference to polarity phenomena.
Canad. J. Res., 1936, 14 : 74-88, bibl. 12.

Ring experiments with the aspen poplar, *Populus tremuloides* Michx., lead to the conclusion that cambial activity is definitely not rigidly or unconditionally polar in its development in the root. A much greater development of cambial activity in the morphologically upward direction was obtained in these experiments than has hitherto been observed. It is suggested that the concept of polarity, applied to cambial activity as a process, must be defined in terms of a tendency to develop in the morphologically downward direction, rather than in the morphologically upward direction in roots and stems. Polarity in relation to cambial activity in general is discussed briefly. [Author's summary.]

251. BOND, T. E. T. 575.255 : 632.4
Disease relationships in grafted plants and chimaeras.
Biol. Rev., 1936, 2 : 269-85, bibl. 108.

The theoretical and practical significance of disease relationships in grafted plants and chimaeras is discussed. The use of grafting as a means of investigating susceptibility to diseases caused by pathogenic fungi and bacteria is described. Transmission by grafting, in the absence of any other causal agency, is now generally assumed to establish the identity of a disease. Inoculation experiments have also been used in the interpretation of graft hybrids and chimaeras. In the case of the artificially-induced *Solanum* chimaeras experiments with *Septoria Lycopersici* have shown that the two components retain their characteristic reaction to infection unaltered. Unless this assumption can be made in other forms, whose mode of origin is unknown, it becomes impossible to distinguish the two components, as such, from the modified tissues of a true graft hybrid. Results with the *Crataegomespili* and *Pirocydoniae* chimaeras are not altogether consistent with the periclinal chimaera theory. The practical importance of grafting is shown in the control of various ills and in the improvement in quality and storage life of fruit which can be brought about by the use of a suitable rootstock. The importance of compatibility between stock and scion is discussed.

252. DELEANO, N. T. 581.144.1 : 581.192
Die Rückwanderung der Stickstoffsubstanz aus den Laubblättern und ihre Speicherung im Stamme und Wurzel. (The return migration of nitrogenous substances out of the foliage leaves and their storage in stem and root.)
Bul. Soc. St. Cluj., 1932, 7 : 45-59, bibl. 33.

The following conclusions are warranted by the above study :—The nitrogenous substances which move back out of willow leaves on the approach of leaf death do not collect in the stem or root, as certain workers suggest, but are actually returned direct to the soil. This backward migration of soluble nitrogenous substances begins simultaneously in leaves and stem. Naturally that from the stem is small, since the actual percentage of such substances in the stem is smaller. During the period of development part of the nitrogenous substances of the stem break down and become soluble (amino acid and ammonium salts), and in their new form travel to the young leaves. This portion of the nitrogenous material corresponds with only a small part of the total protein substances formed in the foliage leaves, since most of these are derived from the nitric and ammonium nitrogen given to the soil. During the period of constancy in the protoplasm most of the proteins remain unchanged both in stem and leaves. During the return migratory period the nitrogenous substances in the leaves decline by some 53% in weight, and in the stem by 13%, which is eliminated from the nitrogenous substances present during the

period of constancy in the protoplasm. The nitrogen which is capable of coagulation, mainly coinciding with the protoplasm, remains unchanged during this reverse migration. Following this the stem proteins break down only during the development period and are so carried to the young leaves, while during the course of this reverse migration the soluble proteins are returned to the soil. [Author's summary.]

253. DELEANO, N. T., AND DICK, J. 581.174 : 581.144.1
Beiträge zur Kenntnis des quantitativen Chlorophyllwechsels der Laubblätter während ihrer Gesamtvegetation. (**Quantitative chlorophyll exchange in foliage leaves during their entire growth period.**)
Biochem. Z., 1935, **279** : 49-54, bibl. 7.

1. The actual chlorophyll content of foliage leaves in *Salix fragilis* and *Populus alba* was determined quantitatively throughout their growing period. 2. The method which was successfully used was that described by the authors in the same journal in 1933. 3. Storing up of chlorophyll takes place in willows for about 70 and in poplars for about 40 days. During the period of development the amount of chlorophyll increases regularly. During the assimilation period, which lasts from 110 to 120 days in both cases, the amount of green pigment remains constant with but slight deviations. In the last 20-25 days the amount of total chlorophyll decreases fast in both cases. The completely yellowed foliage contains only very small, though definite, amounts of chlorophyll. Chlorophyll increases just as much during blossoming as during the rest of the developing period, and blossoming and fruit setting do not affect the regular storage of the green pigments. Willow foliage attains its highest chlorophyll content rather later than it does its highest content in organic and mineral substances and in water. The reverse movement of organic and mineral substances starts appreciably earlier than the disappearance of chlorophyll, and is connected with the disappearance of water. Consequently the decline in chlorophyll is quite unconnected with the decline of the remaining solid constituents and with the decrease in water. Determination of results on 100 leaves (biometric method) gives at once also in the case of the quantitative chlorophyll exchange of the foliage leaves during their entire growing period—as indeed in the case of organic and inorganic metabolism—a clear and rational picture of events corresponding with the fortunes of the plant. [Author's summary.]

254. DELEANO, N. T., AND DICK, J. 581 : 174
Eine neue Methode zur Bestimmung des Chlorophylls. (**A new method of chlorophyll determination.**)
Biochem. Z., 1934, **263** : 317-21, bibl. 6.

A new method of chlorophyll determination is described. It is based on the separation out of the chlorophyll from alcoholic extracts by means of chloroform and the determination of the magnesium which forms the chlorophyll nucleus as $\text{Mg} \cdot \text{NH}_4\text{AsO}_4 \cdot 6\text{H}_2\text{O}$, from the weight of which the chlorophyll can easily be determined.

255. YATES, F. 581.08 : 633.11
Crop estimation and forecasting : indications of the sample observations on wheat.
J. Minist. Agric. Lond., 1936, **43** : 156-62.

The introduction of a measure of control in agricultural production and marketing has added considerably to the importance of problems of crop estimation and the forecasting of yields before harvesting. In a short paper the author describes the methods of crop estimation by means of simple measurements of height and shoot number carried out on random samples from the growing crop. These have been tested for three years on the wheat plots which form part of the Crop-weather Scheme of the Agricultural Meteorological Committee, and a considerable measure of agreement with observed yields has been found. The author further discusses the possibilities of extending the use of these methods to commercial crops, and of thus forecasting the yield of a whole district some weeks earlier than is now possible. T.N.H.

TREE FRUITS, DECIDUOUS.

General.

256. BRYDEN, J. D.

Olive culture.*Agric. Gaz. N.S.W.*, 1936, 47: 108-10, 209-13.

634.63

The factors to be taken into consideration before undertaking the commercial production of olives are discussed. In order to work modern oil extraction machinery at a profit (primitive extraction plants no longer pay) 60 tons of olives equal to the produce of 600 trees would be required. In any case highly lucrative returns cannot be expected. Suitable climatic conditions are mild winters and warm dry summers, with the greater part of the rainfall in winter and early spring. Summer rains cause excessive lateral growth, and autumn frosts below 28°F. will injure the fruit, while 10°F. will injure the tree. For commercial production in New South Wales the olive needs nearly as much water as stone fruit. The most suitable soil is a calcareous loam of medium depth and quality where the percentage of humus and nitrogen is not too high. Soils rich in these two elements produce excessive growth and biennial bearing. Propagation is by budding or grafting 2-year-old seedlings, by hardwood cuttings up to 2 inches in diameter and 10 inches in length (truncheons) placed in a trench at an angle and covered with an inch of soil, and by shoot cuttings taken in winter. Late autumn planting of young trees is advised, or spring planting, if water is available. The advisability of interplanting young olives with a catch crop as practised in other countries is under consideration. The tendency of the olive to biennial bearing can, it is claimed, be reduced by careful cultural attention including regular pruning. Fruit is produced only on growth arising from yearling laterals so that a continuous production of new wood is necessary. Directions for the best method of securing this are given. Olives are believed to be self-fertile and the shy bearing habit of certain varieties is considered to be due to other causes than the lack of effective cross-pollination. Reasonable crops should be borne at 8 years old. Over a period of years the annual yield should be 1½ cwt. of oil olives per tree and 1 cwt. of pickling olives.

257. MOON, H. H., AND OTHERS.

634.25: 664.85.25.035.5

Varietal suitability of peaches for preserve making and factors affecting the quality of the product.*Circ. U.S. Dep. Agric.* 375, 1935, pp. 21, bibl. 17.

The primary object of the investigations described in this paper was to determine the peach varieties best suited for preserve making, the combinations of factors and characteristics which give the highest quality in the product, and the effect of the stage of maturity upon quality. Comparable samples of preserves were prepared from 67 varieties, of which about 40 were freestone types in which the flesh becomes soft and melting as the fruit ripens, 20 were clingstone canning types with non-melting flesh, and the remainder were intermediate semi-melting types. The finished products were graded for five factors, and revealed considerable differences between the two types of peach. As a group the varieties with non-melting flesh made preserves with clearer, more attractive colour, showing distinctly less disintegration of the fruits, with rather firmer, tougher texture, thinner consistency, and less pronounced and distinctive flavour than the varieties with melting flesh. Considerable differences were also found between varieties within each group. When all factors were taken into account, Early Elberta, Ideal, Paragon, and Tuskena were rated as slightly superior. These were closely followed by some 17 other varieties, and in addition 14 varieties are listed which produce preserves somewhat inferior in one respect or another, but which are none the less satisfactory. Final yields, expressed as percentages of the total ingredients when boiling was carried to a uniform end point of 107°C., showed only insignificant differences between varieties. The stage of maturity affected quality greatly. The fruit should be as ripe as possible within the limits imposed by excessive disintegration during processing. For varieties with melting flesh this stage is 2-3 days past shipping ripeness, and for those with non-melting flesh 4-5 days. The proportion of fruit to sugar was also found to have a marked effect. Increasing the proportion of fruit increased the

consistency, decreased the yield, and, by necessitating a longer boiling period, adversely affected colour and flavour. When five lots of Elberta peaches containing 41.7%, 45.8%, 50.0%, 54.2% and 58.3% of fruit were boiled to 107°C., the best product was obtained from the lot with 50% fruit and 50% sugar. The time of cooking was tested with samples boiled to end points ranging from 104°C. to 109°C. The lower end points gave best colour and flavour, but too thin consistency. The product cooked to an end point of 107°C. was the most satisfactory.

*Propagation.**

258. KOTCHERZHENKO, I. E. 634.11-1.535.6

Propagation of fruit trees by root cuttings. [Russian—translated title.]

Nauchnoe Plodovodstvo (Scientific Fruitgrowing), 1936, No. 2, pp. 35-47.

The experiments reported were undertaken at the Mitchurin Research Institute in the Voronesh district of Central Russia. Root cuttings were taken from a number of seedling apples and from cultivated apples grown on their own roots. The length and thickness of the cutting is of importance, the most successful being from 9 to 10 cm. long with a diameter of 0.7-1 cm. Success diminishes with reduction of size. Cuttings taken in the autumn and stratified in sand in a "warm" cellar (the degree of warmth is not stated) give a higher percentage of rooting than cuttings taken and planted in spring. The least successful are those taken and planted in autumn. Vertical and oblique planting gave 71 and 76.3% success against 36% for horizontal planting. Depth of planting exerted considerable influence, 2 cm. below the soil giving the best results, while at 6 cm. successes were practically nil. Age of tree has a definite significance and 2-year-old and strong 1-year-old seedlings form good material, whereas root cuttings from 3-year-old trees were found to form shoot growth without subsequent rooting.

259. ROBERTS, R. H. 634.11-1.541.3-1.541.11

A further trial of ring grafting to produce stock effect.†

Proc. Amer. Soc. hort. Sci. for 1935, 1936, 33 : 358-9.

The data afforded by a second year's observations are tabulated and compared with those for the first year. The differences found are considered to be due to seasonal factors. Thus in 1934 grafts on piece roots of Malling IX grew larger than those on piece roots of Malling XII, whereas in 1935 and normally the reverse holds good. Some of the rings were inverted, i.e. inserted upside down. These gave a very dwarf growth, but, whereas girdled shoots have yellowish leaves, a thick shoot diameter and accumulate starch abundantly, the shoots above the inverted rings had small, dark green leaves, a slender shoot diameter and a slow starch accumulation.

Rootstocks.

260. TYDEMAN, H. M. 634.11-1.541.11

Variation in the Paradise apple rootstocks : A study of some leaf and shoot characters in four races.

J. Pomol., 1936, 14 : 19-25, bibl. 4.

This paper summarizes the results of a study made upon shoots arising from stools of two races of Paradise apple rootstocks, Malling Nos. II (Doucine) and IX (Jaune de Metz) taken in each case from the original collections as received and grouped by Hatton, and from reselected clones raised by repeated vegetative multiplication from a single individual, the object being to determine whether such a reselection from a single individual had decreased the amount of variability or markedly altered the morphological characters in the races concerned, or whether, in grouping the original collections botanically, similar but not identical races had been combined. The

* See also 250, 326, 371, 372.

† See *Ibidem*, 32 : 328, *H.A.*, 1935, 5 : 3 : 365.

following characters were selected as being easily and exactly measurable and representative of vegetative summer shoots. Shape of leaf, i.e. maximum breadth and distance from apex to the point of maximum breadth; length of leaf stalk, expressed as a percentage of maximum length of leaf; number of serrations around leaf margin; length of stipules, averaged and expressed as a percentage of the maximum length of leaf; taper of the apex, measured for breadth 1 cm. below the extreme tip and expressed as a percentage of the maximum breadth of the leaf, indicating the sharpness with which the leaf apex tapers; and number of lenticels upon a measured 10 cm. of wood, 1/2 cm. from the tip of the shoot. The results of the observations are summarized in a table. It is not claimed that we have here a complete picture of variation in the lines of rootstock studied but it does seem reasonable to assume from the data collected that reselection from a single individual has neither decreased the variability nor markedly altered the expression of the characters studied in either of the races of rootstocks dealt with. Variation was found to be considerable both between the shoots on the same stool and between the stools of the same variety and, since such material is presumably genetically identical, this variation must be attributable to environmental differences. H.M.T. (Author).

261. TUKEY, H. B., AND BRASE, K. D. 631.541.11 : 634.11 + 634.14
**What yield of rooted shoots may be expected from mother plantations of
 Malling apple and quince rootstocks?**
Proc. Amer. Soc. hort. Sci. for 1935, 1936, 33 : 338-45, bibl. 3.

The propagation capacity of Malling apple and quince stocks has now been tested at Geneva, New York, since 1928. Vigorous growing types such as I, XII, XIII and XVI were trench layered as follows:—1-year plants were set at a slight angle in the row, 16 to 30 inches apart, in rows 3½ to 4 feet apart. In the first year they were allowed to become established. In the spring of the second year they were bent to the horizontal and the main stem pegged down with wire staples in the direction of the row. Less vigorous types, i.e. II, IX, and the quinces, were raised by mound layering (stools). In this method the plants were set vertically and grown as bushes, being cut back in the second year to about 3 inches from the ground. The soil is an Ontario strong loam, recognized generally as fertile nursery soil. It is inclined to be heavy and to bake unless properly handled. As an aid to ease of propagation and quality of material obtained peat moss is soaked with water and spread broadcast between the rows at the rate of ½ bale to a row 50 feet long and 4 feet wide, or about 50 bales to the acre. This is gradually incorporated into the soil by cultural operations. Returns from the beds from 1928 to 1935 are tabulated under total shoots, rooted shoots and saleable shoots. It was found that the planting distances used, namely 16 vs. 30 inches in the row, were not important factors except in the early life of the plantation, when closer planting gave the larger yield. The more vigorous types soon gave as many plants at 30 as at 16 inches. The number of shoots per acre increased with age of the plantation and appeared to depend on this rather than on season. On the other hand the percentage of saleable shoots per acre varied widely from year to year depending on the season. It was found best to sever the layers as late as possible in the fall or even early December or early spring, since most rooting takes place in the cool of the late fall and early spring, and it is suggested that regions not blessed with a long open fall might thereby be handicapped. It was possible to increase the percentage of rooted shoots per acre by cutting off the tops of quinces and apples found to be longer than is demanded by the nursery trade and lining them out as hardwood cuttings the following year. A good percentage could be relied on to root. An open fall favoured rooting, while a short, dry fall resulted in materially decreased yields. In the latter case the beds should not be cut till the spring. Whereas winter cold did not appear to affect the apple rootstocks appreciably, mother plantations of quince from which shoots were removed in the fall were liable to suffer severely, if a severe winter followed. The authors consider that these stocks, both apple and quince, may be expected under Geneva conditions to give sufficient yields to make their culture commercially possible in the U.S.A. Yields of up to 25,000 saleable apple stocks and up to 30,000 to 40,000 saleable quince stocks per acre can be expected. These can be appreciably increased by the utilization of hardwood cuttings as suggested above.

262. STOUTEMEYER, V. T., AND OTHERS. 631.541.11 : 634.11
Some observations on the production of own-rooted apple stocks from root cuttings.

Proc. Amer. Soc. hort. Sci. for 1935, 1936, 33 : 350-4, bibl. 3.

The material used in these experiments at the Iowa station was the Virginia Crab apple variety. In the year before the experiment attempts to propagate this variety by planting root cuttings in the soil of a bed in the greenhouse were almost entirely unsuccessful. In the experiment itself a closed propagating frame in a greenhouse was maintained at 75°F. by thermostatic control. It was covered with double glazed sash and tightly constructed so as to obtain high humidity and the bottom was covered with 6 inches of moist sand. Roots from scion rooted trees were dug on November 16th and cut into lengths of 6 inches, varying in diameter from $\frac{1}{4}$ to 1 inch. These pieces were laid horizontally on the sand and were fully exposed to the air. In less than 2 months an abundance of adventitious buds had formed from which many shoots had attained a length of 6 inches. No appreciable decay of the succulent young shoots occurred under these hot moist conditions. Very little new root formation occurred on the root pieces in the frame, but on transference to a rooting medium on an open propagating bench there was abundant formation of new roots, all from the root pieces. In other cases the sprouts so formed were removed and used as softwood cuttings, being placed in sand in an open propagating bench in a warm greenhouse. Rooting occurred in 68% and 77% respectively of 2 lots of 100 cuttings so treated. Moreover, the growth obtained from plants started thus was equal to or greater than that which can be got during the first season from a plant grown from seed. The retention of the root piece inhibited the early development of new roots along the stem and did not result in such good plants as were obtained by severed sprouts alone.

263. SHAW, J. K. 631.541.11 : 634.11
The Malling clonal stocks in relation to McIntosh and Wealthy.
Proc. Amer. Soc. hort. Sci. for 1935, 1936, 33 : 346-9.

Apple rootstock experiments at Amherst, Massachusetts, were carried out on stocks imported in 1924 from East Malling, all the numbered stocks being included except VII, XI and XIV. Part of them were budded to McIntosh and Wealthy and the trees set out in 1928. There were only 1-3 trees of each variety on stocks II, III, IV, V, VI, VIII and IX, but 13 or 14 on all the remainder, viz. I, X, XII, XIII, XV, XVI, own roots and seedling roots.* The two varieties were interplanted 20 by 20 feet and included trees on Kansas grown seedling stocks and on own roots. No opportunity was allowed for scion rooting. The trees have now borne two commercial crops. The orchard is managed on the cultivation-cover crop system, only nitrogenous fertilizers being given, and all trees have been pruned to the modified leader type. Three tables show (1) the trunk diameter and yield of the two varieties on the different stocks, (2) the percentage of fruit dropping, and (3) the size of McIntosh apples on the different stocks. The evidence to date allows the author to come to certain conclusions, among which are the following:—Stocks XII and XVI live up to their reputation for producing large vigorous trees. Stock I is a good semi-dwarf stock for McIntosh, but is worthless for Wealthy. None of the dwarfing stocks, except IV and I worked with McIntosh, show any indication of inducing early bearing. Calculations of variability by Bessel's formula show that, whereas Wealthy trees are more variable on seedling than on clonal stocks, the McIntosh trees are less variable only on XVI. "The writer is convinced that most of the variation in growth and production of individual trees in our orchards arises from causes other than the seedling stocks commonly used." [East Malling experience suggests that such a conclusion may be somewhat premature. The number of trees tested was extremely small for any comparison of variability. Ed.] One of the objections to dwarfing stock is its tendency to sprout from the stock. In these trials the semi-dwarfing stocks sprouted less and the very dwarfing stocks more than the seedling stocks. As measured by vigour and productivity McIntosh and Wealthy trees have been slightly superior to own rooted and seedling rooted trees when grown on stocks XII and possibly XVI,

* except Wealthy of which there were 11 trees on I.

and somewhat inferior on stocks X, XIII and XV. On stocks I, IV, V and VI they are half dwarf, except that on I Wealthy is very much dwarfed. The writer recommends XII for standards, I under McIntosh and V under Wealthy for half dwarfs, and IX for dwarfs, but considers it still debatable whether these clonal stocks are sufficiently superior to good seedling stocks to warrant their general use.

264. McCLINTOCK, J. A. 634.11-1.541.11

Some problems in the use of superior rootstocks for fruit trees.

Proc. Amer. Soc. hort. Sci. for 1935, 1936, 33 : 329-31, bibl. 3.

In this article the author urges the use of Virginia Crab seedlings as scaffold builders on the ground that they are very cold-resistant, show considerable and above normal resistance to woolly aphis and are highly resistant to collar rot. Data from Iowa indicate moreover a high resistance to fire blight infection in the top branches, and the author's own two years' observations indicate that its leaves are much more resistant to scab than those of French Crab. It is suggested, however, that the following points need serious thought before growing this scaffold tree for the purpose :—Number of scaffolds wanted, height above ground of first scaffold (it is thought that to avoid the collar rot *Phytophthora* Grimes at any rate should be at least 30 inches above the ground), and the minimum distance between branches of the scaffold tree.

265. KEMMER, E. 634.1/2-1.541.11

Stand der Unterlagenforschung im Obstbau. (The point reached by research on fruit tree rootstocks to-day.)

Forschungsdienst, 1936, 1 : 268-84, bibl. 304.

This very able summary should be of the greatest possible value to all German-reading investigators in pomology. The author jumps to no rash conclusions. He notes progress on primary problems, the emergence of secondary problems and in certain cases the apparently contrary results, which are attributable probably to differences in material or technique and merely stress the necessity for greater uniformity in these particulars. He considers that too scant attention has hitherto been paid to the chemical aspects involved. Thanks are due to him for the well set out and comprehensive bibliography. This is chronological in individual years from 1920-35 and alphabetical within each year. In addition there are 55 references to articles published previous to 1920.

*Rootgrowth.**

266. LINCOLN, F. B. 634.11 : 581.144.2

Root systems of some apple clons.†

Proc. Amer. Soc. hort. Sci. for 1935, 1936, 33 : 323-8.

The author excavated 3-year-old trees, produced by trench layering, of a large number of common apple varieties grown in a well-drained sand to sandy loam soil. He noted that roots penetrated more deeply in places where the soil was heavier and moister. He here gives 5 illustrations each of the root systems of 20 well-known American varieties. The differences in rooting habit are clearly marked. He does not comment on them further.

Pollination.

267. S., G. W. 634.1/2 : 581.162.3

Pollination of fruit trees. Bees in the plantation.

Fruitgrower, 1936, 81 : 963-4.

Hive bees in the fruit plantation have proved infinitely more useful in pollinating plums, cherries and bush fruits than they have in pollinating apples. Bees, contrary to the statements of professional beekeepers, are not fond of apple trees for the collection of nectar. This fact is not considered by the author as a reason for not keeping bees in the orchards, but as a reason for keeping more bees than ever, and in order to induce them to leave the hives and get on to the

* See also 248, 249.

† Anglicè clones.

apples in bad weather populations of the hives must be particularly strong. The hives, too, must be in close proximity to the apple trees because a bee will not change from one kind of plant to another in the course of a journey and it is, therefore, necessary for the apple blossoms to be the first to be encountered when the bee leaves the hive. The author attributes bad crops following dull springs to lack of pollination by bees and other insects, the latter being so largely destroyed by spraying operations and, in the case of wild bees, by the clearing of ditches and hedgerows, that there are not sufficient left to carry out the work effectively. He considers, apart from cultural deficiencies, that small apples are due to bad pollination and attributes the lopsided shape often seen in Early Victoria fruit to the same cause. Fruit that has been properly pollinated is more resistant to spring frosts. Instances of this are given. The poisoning of bees by spray materials has never been known in the author's 15 years of beekeeping and fruit growing, but hives have often been greatly diminished by starvation following the disappearance of fruit blossom.

Growth, nutrition, etc.

268. HOBLYŇ, T. N., GRUBB, N. H., AND PAINTER, A. C. 634.11-1.55

Studies in biennial bearing. I.

J. Pomol., 1936, 14: 39-76, bibl. 3.

This forms the first of a series of studies on biennial bearing at East Malling. The methods employed are stated to be new so far as the authors are aware. Part I. 1. An arithmetical method of evaluating the degree to which trees show the biennial habit is described. 2. The trees' history in this respect is shown by two constants. For any particular period, the constant "B" is calculated to show whether the tree is wholly, partially, or not at all biennial; and the violence of its fluctuations is shown by the Intensity ("I"), calculated from the differences between consecutive pairs of years. 3. The importance of fruit bud formation and its relation to fruit set, in any study of regularity of bearing, is stressed. Part II. The application of the method to the fruit records from the apple pruning plot shows that either "B" or Intensity or both may be affected by:—1. The variety. 2. Root competition from a poplar windbreak. 3. Drastic pruning of formerly "unpruned" trees. 4. A difference in the pruning treatment in the "on" and "off" years. 5. Applications of potash manures. Here results in opposite directions with different varieties were confirmed by changes in treatment. 6. Grassing-down, and subsequently feeding with nitro-chalk. Only one out of six varieties was clearly affected. The causes of fluctuations in biennial intensity are discussed. Part III. Attempts at control. 1. Stripping the blossom from whole trees of Early Victoria completely changed the year of cropping and increased biennial intensity; thinning had no effect. 2. Stripping the blossom of certain branches or parts of trees gave results differing with the variety. Usually the year of cropping of the stripped parts was changed. 3. Comparison of stripped and untreated branches with whole trees stripped or untreated shows a lower and falling biennial intensity for the former. Differences between partly treated trees could be accounted for by the varying proportion of the whole tree's blossom removed. 4. Results as a whole strongly suggest that differently treated branches of the same tree did not behave independently. 5. No difference was discernible in the results obtained from early and late stripping of the blossom. 6. No result was obtained from blossom thinning. 7. In an experiment carried out on young trees of Upton Pyne and Laxton's Superb, the complete removal of fruit each year clearly overcame the biennial habit. Heavy thinning certainly reduced biennial intensity, but the effect of light thinning, though in the same direction, was not significant. [From authors' summary.]

269. BRADFORD, F. C., AND JOLEY, L. E. 634.11:581.143:581.08

Evaluation of length measurement in an experiment with apple trees.

J. agric. Res., 1935, 51: 1123-8.

It is pointed out that measurements of annual wood growth, as a measure of increased vigour in apple trees, are of limited value, similar total growths often being made up of widely different numbers of shoots of different average length. For this reason the recording of vigour as an

increase in weight is advocated and the provision of measuring rods graduated to record the weight of the shoot measured suggested. Working on the branches pruned off Red Canada apple trees in March 1935, it was found that the relationship between weight and length of a shoot was very nearly expressed by the formula $X^2=3 \cdot 1Y$, where X is the length in centimetres and Y the weight in grams. Graduated scales based on this formula gave a close agreement with the actual weights recorded. The authors are of the opinion that, once the values for each variety and condition are established, there need be no increase whatever in the labour of recording by this method. [It should be noted, however, that the values on the scale would have to be calculated anew every season for every variety and treatment in the experiment, since all these may influence the weight per unit length; and this would probably prohibit the use of the method in all but the simplest experiments. Abstractor's note.] T.N.H.

270. GRAINGER, J., AND ALLEN, A. L. 634.1/7 : 581.144/5

The internal temperatures of fruit-tree buds.

Ann. appl. Biol., 1936, 23 : 1-10, bibl. 6.

An investigation, designed to study the relation between the temperature of the air and that within dormant and opening buds of apple, blackcurrant and raspberry at any time during the day or night and under varying climatic conditions, is described. Temperatures were measured by thermoelectric methods. Results from two varieties of apple, Bramley's Seedling and Worcester Pearmain showed very close coincidence. By day their buds were warmer than the air, by night usually cooler. Buds shaded with a zinc screen were, however, cooler than the air by day as well as by night, thus indicating that warming seems to be effected by radiation from the sun. Cooling would appear to be a direct result of evaporation from the bud, with radiation as an important secondary factor on clear nights. The buds of blackcurrant and raspberry were in a more advanced stage of opening than those of apple when the records were taken, and were found, particularly in the case of blackcurrants, to be generally cooler than the air at all times, thus suggesting that loss of heat through evaporation dominates even the warming effect of the sun during the day. Records obtained during a slight frost confirm the idea that the apple bud has a mechanism for frost resistance, which is apparently not possessed, or at any rate shown in the same degree, by the blackcurrant.

271. DOVE, W. F., AND MURPHY, E. 634.11 : 577.16

The vitamin C content of apples and its relation to human welfare.

Science, 1936, 83 : 325-7, bibl. 10.

In apple growing regions, the apple could be depended upon as the principal source of the antiscorbutic vitamin C. The tendency in certain districts to concentrate upon a single variety will prove to be biologically unsound, if no attention is paid to vitamin selection, because some varieties are very much poorer in vitamin C than others. Delicious, the commonest variety in the U.S., is one of the poorest in vitamin C. It has been argued that in the breeding of new varieties the consumers' requirements must govern selection. The vitamin content is not considered, and in any case it takes many years at present, before the fruits of new apple varieties can be analysed. The authors have made determinations of the vitamin C content of the leaves of two varieties, one low and one high in vitamin C, during and after fruit harvest, to see if any association exists between vitamin contents of the leaves and fruit. Preliminary results, which are presented here, indicate that the content of the leaves does, in fact, bear a direct relation to the content of the fruit. Further tests are in progress to determine the earliest age at which differences in ascorbic acid content of the leaves or other non-fruitle parts of the plant are detectable.

272. TODHUNTER, E. N. 634.11 : 577.16

Vitamin values of some varieties of apples.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 43-7.

Investigations on the vitamin C content of apples have shown it to vary with the variety. Of the varieties tested Winesap and Golden Delicious proved to be richest, whereas Jonathan,

Delicious and Richared contained only about half the vitamin content of Winesap. The cause of these differences is as yet unknown. Storage effect was studied with Delicious and Richared. Apples stored at 45°F. for 3 months lost $\frac{1}{3}$ of the vitamin value, for 6 months $\frac{1}{2}$, and for one year about $\frac{1}{2}$. No vitamin C was lost when apples were stored for 6 months at 32°F. A definitely higher vitamin C value was recorded in apples from trees fertilized with ammonium sulphate, sodium nitrate, superphosphate, and muriate and sulphate of potash as opposed to apples from trees receiving no fertilizer. A low leaf to fruit ratio of 10 : 1 in Delicious and Winesap resulted in higher vitamin C values than a high ratio of 50 : 1. This may, however, be explained by the smaller size of the fruit from the low ratio trees, and hence the higher proportion of skin to flesh. The skin is considerably richer in vitamin C than the same weight of flesh, and studies now in progress with Golden Delicious appear to indicate that at least twice as many peeled apples as unpeeled ones are needed to supply the same amount of vitamin C. A note is added on vitamin A to the effect that five varieties tested showed a vitamin value comparable with that of other fresh fruits.

273. HANSEN, E., AND HARTMAN, H. 634.13 : 581.192

The occurrence in pears of metabolic gases other than carbon dioxide.

Sta. Bull. Ore. agric. Exp. Sta. **342**, 1935, pp. 10, bibl. 17.

Ripening pears were placed in airtight containers with young tomato plants or with germinating pea seeds, and were kept at 65°F. A second series of unripened pears was held at 31°F., and the gaseous emanations from them collected and released later at room temperature into a jar containing a tomato plant. Check experiments were conducted in each case, and jars were also included, in which tomato plants and germinating seeds were subjected to various concentrations of ethylene. The presence of pears in closed containers induced epinasty in the tomato plants and retarded the germination of seeds, regardless of whether the pears were held at room temperature or in cold storage. The symptoms produced were indistinguishable in outward appearance from those caused by ethylene, and chemical evidence is also recounted which indicates this to be the substance responsible. Further tests were made to determine the effect of the gas evolved by ripe pears on the rate of ripening of other lots of pears. A pronounced acceleration in the rate of ripening occurred in the case of newly picked fruit, but no response was obtained from fruit that had been held in cold storage for a short period.

274. WORK, R. A., AND LEWIS, M. R. 634.13-2.112 : 631.432

The relation of soil moisture to pear tree wilting in a heavy clay soil.

J. Amer. Soc. Agron., 1936, **28** : 124-34, bibl. 21, being *Tech. Paper Ore. agric. Exp. Sta.* **241**, 1935.

A large Anjou pear tree, 26 years old, formed the subject of the study described here. Permanent wilting percentages of the soil, which was a clay adobe, were determined for each of the four upper feet. On August 19th the tree first showed signs of wilting, yet 42 soil samples taken on that day revealed the average moisture contents of the first, second, third and fourth feet to be 5.2, 4.3, 4.7 and 3.2% respectively above the average permanent wilting percentages for corresponding depths. Extraction of moisture from the soil by the tree was still proceeding at an almost normal rate. Subsequently partial defoliation accompanied wilting and the rate of moisture extraction gradually slowed down, until by September 15th it had ceased. The withdrawal of moisture from the second, third and fourth feet stopped when the average moisture contents were still about 3.2, 2.7, and 1.1% respectively higher than the permanent wilting percentages. It is pointed out that movement of water through the soil by capillary action was too slow to maintain a uniform content, and previous work is cited which indicates that the roots do not seem to occupy the entire soil mass. The authors, therefore, consider that the following hypothesis appears to be valid :—"The soil moisture content of the soil in contact with the feeding roots may be at or near the permanent wilting percentage, while at the same time the moisture content at some distance, perhaps only a few millimetres away, may be much higher, thus allowing the average content for an ordinary soil sample to be well above the wilting percentage at the time a tree shows serious distress for need of water."

275. SWEET, A. T. 631.4 : 634.1/2
Soils of Orleans County, New York, in their relation to orchard planting.
Bull. Cornell agric. Exp. Sta. **637**, 1935, pp. 32, bibl. in text.

Orleans County is in one of the most important fruit-growing districts of New York State. In the first part of this paper a general account is given of climatic conditions, orchard-soil requirements, selection of site*, soil maps, and soil groups of the area. The importance of good drainage is stressed. Sweet cherries are particularly sensitive to excessively wet soils, and next in order come sour cherries, peaches, apples, plums and prunes, pears and quinces. Apple roots in well-drained soils penetrate to 8 feet or more, but in sites with poorly-drained subsoil they may penetrate only 3 feet or less. Trees with shallow root systems tend to yield erratically, being affected adversely when seasons are either too wet or too dry. Individual descriptions are given of the soil series existing under some eight soil groups found in the area, and the suitability or otherwise of each for orchard planting is noted. The following general conclusions are drawn:—With the exception of climatic conditions soil is the most important factor in selecting an orchard site. The character of soil can only be fully determined by a careful field examination. Features characterizing good orchard soils are nearly uniform colour of soil and subsoil, medium texture, friable structure, and good depth, changes in colour, texture and structure being gradual rather than abrupt. A dark surface, a subsoil containing layers of light grey with marked yellow and rusty brown mottling, and clay, compact sand, or rock at shallow depths each indicates a poor soil. Soils with high water tables should be avoided.

Manuring, cultural practice.

276. GRAY, G. F. 634.1/2-1.841.6
Observations in 1935 on the use of calcium cyanamid in orchards.
Quart. Bull. Mich. agric. Exp. Sta., 1936, **18** : 170-2.

Experiments described in an earlier paper* on the use of calcium cyanamide as a fertilizer for several tree fruits have been continued during 1935. Comparison of autumn and spring applications yielded somewhat inconclusive results. Summer drought conditions were as acute in certain districts as in 1934, but in no orchard was there any repetition of leaf scorch and defoliation. This is thought to be due to the lower temperatures prevailing in 1935 than in 1934. No benefit to the trees was observed from applications of superphosphate and potash, although in several cases cover crops and weeds responded to potash with increased growth. The place of calcium cyanamide as an orchard fertilizer therefore remains unestablished. The recommendation that, if cyanamide is used, it should be applied in the autumn or very early in the spring is reiterated.

277. MORRIS, O. M. 634.1/2-1.874
Orchard cover crops.
Proc. Wash. St. hort. Ass. for 1935, 1936, **31** : 65-7.

Fifteen to twenty years ago orchards in Washington were clean-cultivated and irrigation furrows were spaced only 24"-36" apart. With the development of cover-cropping, particularly with alfalfa, irrigation furrows were commonly placed 4'-10' apart. The stand of alfalfa was regarded as permanent, but this conception has led to several adverse effects. In the first place natural reseeding of the cover crop is insufficient alone to maintain a good stand. Secondly, the effect of wide irrigation furrows has been to limit concentrations of tree roots and the production of nodules on the roots of the alfalfa to the moister soil near the furrows. Very few nodules have been found on roots below 15" and none below 22", and in the drier areas between the furrows the alfalfa root systems consist mainly of deep roots with no nodules. Such plants are thought to be of little or no more value as cover crops than weeds. The author considers, therefore, that alfalfa should not be regarded as a permanent cover crop until better methods of maintaining a stand have been evolved. He advocates a temporary return to clean cultivation in many apple

* Cardinell, H. A., and Gray, G. F. Defoliation from the use of calcium cyanamid. *Ibid.*, 1935, **17** : 101-5. H.A., 1935, **5** : 2 : 191.

and pear orchards, so that furrows may be remade at not more than 30" apart. This will produce a more uniform distribution of tree roots, and will also be a good preparation for reseedling and establishing a new cover crop.

278. READ, F. M. 634.1/7-1.8

Soil fertility in the orchard. Artificial and green manures.

J. Dep. Agric. Vict., 1936, 34 : 128-34, 150.

The general principles involved in the manuring of fruit trees, and their particular applications under conditions in Victoria are discussed. The first essential is the provision of ample humus, and, where orchards are normally clean-cultivated and no farmyard manure is available, it is suggested that a green manure crop be sown in the autumn for ploughing under in the spring. Alternatively, a plant such as subterranean clover which will reseed itself after ploughing may be established, or as a stopgap the natural weed herbage may be allowed to grow over the winter. In applying artificial fertilizers the appearance of the trees and not the crops they bear should be the prime consideration. It is healthy medium growth, and not weak nor very vigorous growth which induces the most fruitful conditions. As far as may be approximated a balanced fertilizer dressing should be applied, except when the trees show definite deficiency symptoms for one or other constituent. Where a green manure crop is being grown, an autumn application of 1-2 cwt. sulphate of ammonia or superphosphate, depending on the state of the trees or the crop, is recommended. A spring application 2-3 weeks prior to bud burst might be a 2 : 2 : 1 mixture or sulphate of ammonia at 3 lb. per tree. For citrus a good practice is to apply 3 lb. sulphate of ammonia in the spring and again in the autumn. In choosing fertilizers preference should be given to those that are quick acting. Phosphates and potash which are liable to become rapidly fixed in the soil should be introduced, when possible, into the actual root zone by deep ploughing, or by irrigation or rain water.

279. STEPHENSON, R. E. 634.1/2-1.874

Humus and cover crops in relation to orcharding.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 59-64.

Next to water humus may be regarded as the most important factor influencing the growth and yields of crops in the field or orchard. The effect of continuous clean cultivation is to deplete the humus, and results in leaching of nitrates, and deterioration of soil texture. Cover cropping, especially with legumes, is the cheapest and most effective means of renewing humus in orchard soils. By cover cropping leaching and erosion are checked, tillage expenses are reduced, the danger of the formation of plough pans is largely eliminated, and water penetration in irrigation is improved. An expenditure on fertilizers for the cover crop, if necessary to assure its success, is justified, because these should result in an increase in humus, and will ultimately become available to the trees with the decomposition of the green manure.

280. McCUTCHEON, W. 634.1/2-1.67

Hints on orchard irrigation.

Agric. Gaz. N.S.W., 1936, 47 : 33-4.

It is pointed out that salts in the soil tend to move horizontally at right angles to the general movement of water. The exclusive use of two furrows for irrigation between rows of trees or vines is therefore deprecated, because it increases alkali concentrations in the rows, that is at the outer edge of the penetration of soil water. Where furrow irrigation is practised, it is suggested that as many furrows as are practicable should be used, or where only two or three are used, then the rows themselves should be periodically subjected to irrigation. Waiting for the soil to "blacken" (moisten) in between the furrows is considered to be unreliable as an indication that the soil is fully irrigated, because, before this occurs, much water will have already penetrated well below the root zone. Spray irrigation can be used only for such crops as are not susceptible to rain damage or fungus diseases. It is unsuitable for use on grapes, but for citrus on the lighter, sandy soils it is the only system that has been found to combine control of water, efficiency and economy. Flood irrigation has much to recommend it, where the area concerned is almost level from the supply channel.

281. RICKS, G. L., AND GASTON, H. P. 634.11-1.542
The "thin wood" method of pruning bearing apple trees.
Spec. Bull. Mich. agric. Exp. Sta., 265, 1935, pp. 45 bibl. 20 ; summarized by
 MARSHALL, R. E. 634.11-1.542
The "thin wood" method of pruning.
Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 55-8.

Jonathan apple trees were divided into three parts in order to obtain cropping records. Of these portions the "inside" of the trees produced only 15% of the total yields and predominantly low grade fruit ; the "lower outside" produced 36%, most of which was average grade ; and the "top" produced 49%, which was mainly high grade fruit. This indicates that in thinning out the top and outer parts of the tree to admit light to the centre some of the most valuable wood is removed to produce a limited improvement of the poorest apples. A study was also undertaken of branch performance in 8 varieties. Three classes were recognized based on diameter measurements of 4-year-old wood. It was found that both the number of apples produced and their size increased with the thickness of the branch, and that thickness was also associated with colour development of the apples. From this it is estimated that a thick branch (over $\frac{3}{8}$ " diameter) has at least 10 times the value of a thin one (under $\frac{1}{4}$ " diameter). In general it was also found that intermediate branches grew twice, and thick branches three times, as rapidly as did thin ones. From these data it is inferred that the removal of thin branches has little effect on reducing yield, and secondly that it results in a distinct improvement in grade through eliminating low quality apples. With these considerations in mind the "thin wood" method of pruning has been evolved. It is characterized by the removal of branches making short terminal growths and having 4-year-old shoots of diameters less than $\frac{1}{4}$ ". The steps needed to produce this result are given as follows :—1. Saw off a few large horizontal branches, which appear to be carrying a considerable number of thin type laterals. 2. Remove the remaining thin wood from the lower centre portion of the tree, while standing on the ground. 3. Finally some thin wood in the upper part of the tree will probably have to be removed. Summarizing, the authors claim the following advantages for this method of pruning :—It results to a marked extent in (1) a decrease in the yield of inferior fruit, (2) an increase in the average size of fruit, (3) an improvement in colour grade, and (4) an increase in monetary returns. (5) It requires less time and is less costly than the more conventional methods of pruning. (6) Spraying is easier and more effective. (7) Thinning and (8) harvesting are easier and less expensive. (9) The danger of sun scald is reduced. (10) There are fewer water sprouts and therefore less fire blight. (11) It can be used on bearing trees of all ages, and (12) does not throw young trees out of bearing as may other methods. (13) It tends to reduce the number of pickings necessary. (14) It minimizes frost hazards.

282. DUFOUR, A. 634.1/7-1.542.24
 Les incisions aux arbres fruitiers. (**Incising fruit trees.**)
Rev. hort. Suisse, 1936, 9 : 103-5.

Incising the bark of fruit trees is advocated as a method of increasing growth at desired points in fruit trees. The cuts should be made through the cambium with a sharp grafting knife and should just not reach the wood. The effect of the incisions is to stimulate a flow of sap to the locality and the operation should be performed only between April 15th and the end of June. When a young tree is headed back with a view to producing a framework of five laterals and a leader, or when a year-old scion is cut back ultimately to form a pyramid, the resulting terminal shoot and one or two nearest to it will be more abundantly nourished than those lower down. Three longitudinal incisions two or three centimetres below a bud and a transverse incision above it will ensure a badly placed bud receiving sufficient sap to allow it to develop as vigorously as those in better positions. Weak branches which unbalance a tree can be given increased vigour by incisions starting below the junction with the trunk and continuing along the upper surface or sides of the branches to be treated. This method can be used in conjunction, if necessary, with other customary measures, such as the omission of pruning or the removal of all fruit from the branch. Bark splitting on tree trunks can also be prevented by a series of longitudinal

incisions 10-30 cm. in length, disposed at intervals one above the other but slanting alternately to right and left, from the ground level to the crown. This broken line is considered better than a continuous zigzag cut. Incisions are made on the shady side of the tree. Trees which have been top grafted can also be helped by incisions. Stone fruit trees require more care in making the incisions than do pome fruit trees. The incisions with the former should be quite short and great care must be taken that the wood is not injured.

283. SNYDER, J. C.

634.1/2-1.45

Crops planted in pulled orchards.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 48-54.

Considerable difficulty has often been experienced in the Wenatchee and Yakima valleys of Washington State in establishing young fruit trees, vegetables, or cover crops on the sites of old apple orchards, which have recently been grubbed. A number of cases resulting in failure are instanced here. The suggestion is made that the cause of the trouble may be connected with toxic concentrations of lead arsenate in the surface soil. There is evidence that this salt does not penetrate below a few inches in the soil, and thus with annual spraying accumulates gradually near the surface. Estimations of organic matter in soils have indicated that the trouble cannot be entirely a matter of humus deficiency. The fact that liberal applications of manure have produced beneficial results suggests that additions of large quantities of organic matter may cause binding of soluble arsenic. There is evidence that additions of iron also render the soluble arsenic insoluble, and this possibility is being investigated. It is pointed out that in certain other apple growing sections no trouble has been encountered in establishing new crops in pulled orchards.

SMALL FRUITS, VINES, NUTS.

284. HOWELL HARRIS, G.

634.711

Raspberry nutrition. II*. Causes of raspberry failures in the coastal area of British Columbia.

Sci. Agric., 1936, 16 : 353-7, bibl. 4.

The seasonal trend of available nutrients in a fertile soil in British Columbia shows minima in March and July and maxima in May and September, thus giving a definite lead as to the most advantageous time for the application of fertilizers. The tables drawn up by the author in making the above observations are used to diagnose soil troubles from raspberry plantings. Some typical conditions responsible for poor growth and low yields in coastal British Columbia are as follows. *Nitrogen* deficiency. This is the most common difficulty, many soils being almost entirely depleted. Two or three years of regular applications may be required to restore the soil to a satisfactory biological condition. *Lime* is frequently deficient. *Phosphorus* deficiency is a more complicated problem. Soils giving a low phosphorus test nevertheless yield well. Other soils show a high phosphorus content at some periods and an almost negative test at others. The application of lime to a soil low in phosphorus may cause a phosphorus deficit. *Potash* deficit is a frequent cause of low yield. If the soil does not respond to ordinary applications, extremely large applications may be made until the soil complex is saturated with it, or an application of sodium nitrate may temporarily serve the purpose of supplying both nitrates and potash†. *Soil acidity*. Some acid soils grow good raspberries, whereas others of the same degree of acidity give poor results. Availability of nutrients is very closely tied up with acidity. In general the essential ones are rendered insoluble while the toxic ones, e.g. iron and aluminum, which are beneficial in small quantities become soluble and injurious under acid conditions. *Unbalanced nutrients* are often a cause of trouble. *Cover crops*, during their first year undoubtedly reduce the soil nutrients below that of clean cultivation. Before planting cover crops soil

* Part I of this series appeared *Ibidem* 1935, 15 : 525-34, *H.A.*, 1935, 5 : 3 : 372.

† by base exchange.

deficiencies should be determined and repaired. *Root injuries* are largely due to excess moisture, particularly in winter. Reasons for this are explained. The writer considers that nutritional disorders are responsible for most of the difficulties encountered in the small fruit industry of British Columbia.

285. WEETMAN, L. M. 635.61

Correlation of shape of fruits, cotyledons, and seeds in melons.

Bot. Gaz., 1935, 97 : 388-98, bibl. 10, being *J. Pap. 1a. agric. Exp. Sta.*, J196.

Arising out of observations made in connexion with the breeding of wilt-resistant watermelons, *Citrullus vulgaris* Schrad., a study was undertaken to determine what relationships might exist between shape of cotyledons and shape of fruits, shape of seeds and shape of fruits, and shape of seeds and shape of cotyledons. Correlation coefficients were calculated by using shape indices. Correlations between and within varieties as well as total correlations of variations in shape were determined by employing the methods of analysis of covariance. In watermelons shape of cotyledons was significantly and positively correlated with shape of fruits, and shape of seeds with shape of cotyledons and with shape of fruits. In citrons and in watermelon-citron hybrids no significant correlation of shape of cotyledons with shape of fruits was found, but in the case of a small group of plants of *Cucumis melo* L. a positive correlation was obtained. Watermelon cotyledons changed in shape as the seedlings grew, the relative length increasing more rapidly than the width. It has not yet been determined at what age they assume a constant shape. In the present study cotyledon measurements were taken after the first and second leaves had formed on most of the seedlings. In conclusion it is stated that in many watermelon varieties, and particularly in the variety Iowa Belle, fruit shape can be foretold from an examination of the cotyledons. It is pointed out, however, that much more accurate forecasts can be made of the mean shape of fruits of a variety or selection than of the fruit shape on an individual plant.

286. HARMON, F. N., AND SNYDER, E. 634.8 : 575.252

A seeded mutation of the Panariti grape.

J. Hered., 1936, 27 : 77-8.

The Panariti grape normally produces small seedless berries. In 1934 one shoot of a vine growing at Fresno, California, was found to be bearing two perfect clusters of large berries containing viable seeds. Buds propagated on other vines bore similar clusters in 1935, thus indicating a definite somatic mutation. The seeded variant in several forms was also found in some commercial Panariti vineyards. The new type may be of some use in breeding work and is of interest as one of the few grape mutations on record, but commercially it is detrimental, and vines showing mutant shoots should be marked for elimination during the fruiting season.

287. DE CASTELLA, F. 634.836.72

***Phylloxera*-resistant vine stocks (IV).**

J. Dep. Agric. Vict., 1936, 34 : 89-97.

Parts I, II and III were noted in *H.A.*, 1936, 6 : 1 : 50. In Part IV the author continues his descriptions of *Phylloxera*-resistant vine stocks, this time concentrating on some hybrid stocks which owe their origin in part to such North American species as *Vinifera monticola*, *V. aestivalis*, *V. arizonica*, *V. cinerea* and *V. candicans*. The main features of the species themselves are first outlined briefly.

288. FINCH, A. H., AND VAN HORN, C. W. 634.521 : 581.144.1

The moisture relations of pecan leaves.

Science, 1936, 83 : 260.

In studying the effect of soil moisture on pecan leaves, comparisons were made between trees growing on wet and dry plots. In the former soil moisture was maintained at near field capacity ; in the latter moisture was kept below the wilting point in the first two feet and below optimum at lower depths. No wilting occurred in the dry plots, but leaves were smaller, thicker, less

green, and lacked a fresh appearance. In many cases a typical marginal "drouth necrosis" became evident. Under conditions of maximum transpiration, however, the moisture percentage in mature leaves was almost the same for both treatments. Slight increases in moisture content were found at night and during cloudy and humid days, and these increases were greatest in leaves from wet plots. Leaves showing drought necrosis transpire very slowly, if at all, but a considerable degree of drought appears to be necessary before transpiration or the entrance of CO₂ are checked in healthy leaves. This is apparent in the greater amount of starch and hemi-cellulose cell wall thickening in shoots from the dry plots, whereas the nitrogen content in leaves and other tissues is reduced. It is suggested that by soil moisture control it may prove possible to regulate the formation and utilization of carbohydrate reserves in the tree.

289. STANSEL, R. H. 634.58

Peanut growing in the Gulf Coast prairie of Texas.

Bull. Tex. agric. Exp. Sta. 503, 1935, pp. 16.

This paper contains information on the peanut industry in the U.S.A., on the effect of rainfall and temperature on cropping, and on the composition and uses of the nuts and vines, but its main purpose is to report the results of experiments with varieties and spacing of peanuts carried out at the Angleton Station from 1915 to 1933. Two small-podded varieties, Spanish and Macspan, produced the highest average yield of nuts, 1,268 and 1,290 lb. per acre respectively. Of the other varieties, which were all long-podded, Carolina Runner produced 1,179 lb., Virginia Runner 914 lb., Virginia Bunch 843 lb., Valencia 543 lb., and Tennessee Red 526 lb. The two last named have the best flavoured nuts. In production of air-dry forage, i.e. vines and nuts, Carolina Runner ranked first with an average yield of 3.19 tons per acre over 7 years. Macspan, Spanish and Virginia Runner averaged over 2 tons. For the Gulf Coast Prairie of Texas, where yields of both nuts and forage are considered, the best varieties would then appear to be Carolina Runner, Macspan and Spanish. Spacing trials with Spanish indicated that the best yields of both nuts and forage were obtained by close to medium spacing of 6"-12" in rows 3 feet apart.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

290. WEBSTER, J. L. 634.11-2.111

Lessons learned from the recent severe winter injury in eastern Canada and the United States and its probable effect on the industry in western apple producing sections.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 68-73.

It has been variously estimated that between 2 and 2½ million fruit trees were killed outright or seriously injured in eastern Canada and the U.S. during the exceptionally cold winter of 1933-4. The form taken by the injury on apples has been the subject of investigations at MacDonald College, Quebec, and the results obtained are summarized here. No trace of root injury was discovered. A deep snow covering prevented very low soil temperatures and the minima recorded were - 3°C. at 1 ft. and - 1°C. at 2 ft. Above ground low temperatures appeared to affect the tissues of the trees in the following order :—pith, sap wood, fruit buds, cortex or bark, and lastly cambium. These forms of injury increased in the same relative proportion. Damage to the sap wood was undoubtedly the most serious. Trees so injured usually had a living cambium and produced leaves in the spring, but failed to grow further. When frozen, the tracheae become clogged with decomposition products and the upward movement of water ceases. Laboratory tests in which water was passed through normal and damaged shoots under pressure confirm this. Data from a manurial trial indicated that trees heavily fertilized with nitrogen suffered no more than those receiving a regular, complete fertilizer. Trees which had borne a very large crop the previous autumn suffered distinctly more severely than those which

* See also 251.

had borne a fairly light crop. Pruning, except when severe, or as in grafting or dehorning, did not appear to increase injury to any extent. An examination of several hundred crotches revealed considerably more frost canker in those that were acute angled. Trees 6-12 years old were injured less than aged trees or nursery stock. Questions of location and drainage are discussed. Finally the relative hardiness displayed by the principal commercial, and some new varieties is noted.

291. SMITH, E. 664.85.11 : 632.111

Fruit injury from low temperatures.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 74-7, bibl. 5.

An account is given of the physiological changes which occur in the tissues of apple fruits as a result of exposure to freezing temperatures, and which result in injury.

292. CLAWSON, O. T. 634.11-2.111

Injury caused by the recent freeze.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 81-4.

This paper embodies the report of a committee which was asked to investigate the various degrees of injury caused by recent low temperatures during harvest. Apples of a number of varieties were examined. They were divided into two groups, A, those which were handled while in a frozen condition, and B, those which were not handled but were covered up and left in the orchard until they had thawed. The results of the study are recorded, and from them it has been found possible to make a number of observations with regard to the treatment and handling of frozen apples. Briefly these are:—Frozen apples with a core temperature not lower than 28° F may be moved into protective storage, but, if much jolting is entailed on the journey, less loss will be incurred by leaving them in the orchard. Frozen fruit always shows more severe wastage than unfrozen fruit. Frozen apples which have thawed to slightly softened condition should not be moved under any circumstances. Fruit left in the orchard or in store should be stacked so as to permit free circulation of air on all sides of the boxes, but in such a manner that the free circulation of air can be stopped, if cold weather supervenes. The boxes in the orchard must in such case be closed up together and supplied with a protective covering, e.g. hay, weeds or paper. Frozen apples can be thawed at from 32°F.-40°F., provided the air circulation is continuous, and they should not be packed until time allows any injuries incurred by freezing to become obvious. Proper ventilation and air circulation will allow frozen fruit to lose the fermented taste characteristic of it more quickly.

293. WILSON, J. D. 016 : 581.02

Environmental factors in relation to plant disease and injury : a bibliography.

Tech. Ser., Bull. Ohio agric. Exp. Sta. 9, 1932, pp. 203.*

The author writes, "This bibliography is an assembly of some of the papers in botanical literature which make reference to the influence of those environmental factors which are, in particular instances, either directly or indirectly harmful to plants. These factors may act directly on the plant, as in the freezing, desiccation, scalding, or poisoning of its tissue, or they may affect a host indirectly by exerting an influence on some host-parasite relation. In other instances, the factor involved may act only on a pathogen without reference to a host." The first Section of the paper consists of 3,689 references arranged according to senior authorship in alphabetical order. Section 2 consists of an environmental factor index, and Section 3 of a host-disease-injury index, to which a host index of scientific names is attached. By this arrangement it is a simple matter to obtain the references either on environmental factors in their general relationship to plant diseases and injuries, or on a particular disorder of any one plant. Altogether a comprehensive work, this bibliography should prove to be of very considerable value.

* Received 1936.

294. ASKEW, H. O., AND OTHERS. 634.11-2.1
Internal cork of apples, Nelson, New Zealand. A study of moisture relations of soil and fruit.

N.Z.J. Sci. Tech. 1936, 17 : 595-9, bibl. 4.

The hypothesis put forward by earlier workers, particularly in America, that internal cork of apples was a result of a water deficiency within the tree caused by transpiration through the leaves in excess of the replacement through the root system, was investigated for Jonathan and Dunn's Favourite apples in the Nelson district, New Zealand. The experimental blocks, each containing both varieties of apples, were at Braeburn, where the fruit was known to be usually badly infected with internal cork, and at Mildura, where the fruit is reputed to be comparatively free. On the Dunn's block at Braeburn there was a higher percentage of soil moisture for the first half of the season and a lower percentage for the second half than at Mildura. No cork developed on either Dunn's plot till the second part of the season (January 7th) after which incidence became appreciable and was finally classified as "moderate" at Braeburn and "rather bad" at Mildura. The incidence was heaviest on the plot carrying the heaviest crop. The moisture content of the Dunn's fruit at Braeburn was consistently lower than at Mildura particularly in the second half of the season. On the Jonathan block at Braeburn the soil moisture was consistently higher throughout the season than at Mildura. At Braeburn internal cork became progressively more serious after November and finally affected 75% of the fruits, being classified as "very bad". Cork on the Jonathan plot at Mildura was nil. The affected Jonathans at Braeburn were, as with the most affected Dunn's, the heavier crop. The moisture percentages of the fruit of the two Jonathan crops was about the same on any given date, though the two soil moisture percentages were not. The authors summarized as follows:—(1) Determinations of soil moisture and of physical properties of soils conducted on two orchard areas did not indicate that internal cork of Nelson apples was caused by a particularly low moisture content of the soil. (2) Determinations of moisture content of Jonathan and Dunn's Favourite apples from two orchard areas showed no positive correlation between incidence of "cork" and low moisture-content of fruit. (3) The investigations negative a theory of water deficiency as the primary cause of "cork" ailments, but do not preclude the probability that a low moisture supply on any soil subject to cork ailment does not accentuate the trouble.

295. REEVES, E. L. 634.23-2.1
Mottle leaf of cherries.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 85-9, bibl. 2 in text.

The symptoms of a disorder of cherry trees referred to as "mottle leaf" are described, and observations on its detrimental effect on the fruit are outlined. Experiments were started in 1933 in an attempt to determine the nature of the disorder. Microscopic examination failed to reveal any fungus or bacterial organisms. Injections with salts of zinc, copper and iron gave negative results, thus failing to show whether mottle leaf was related to disorders such as little-leaf, exanthema or chlorosis. Water extracts made from tissues of trees showing mottle leaf were injected into apparently normal trees without any effect. Transmission from diseased to healthy trees has, however, been achieved by budding and grafting, though not so far by root grafting. This occurred both from rootstock to scion and vice versa. Insufficient data have been collected to suggest definite remedial measures, but since such trees are undesirable and there is no record of a tree having recovered from the disorder, it is recommended that affected trees should be removed as soon as they no longer bear a commercial crop.

296. KUNKEL, L. O. 634.25-2.8
Immunological studies on the three peach diseases, yellows, rosette, and little peach.

Phytopathology, 1936, 26 : 201-19, bibl. 5.

Yellows, rosette and little peach are three virus diseases of peaches prevalent in the eastern U.S. Rosette is the most severe and little peach the least. All cause stunting, the abnormal production

of secondary shoots, and yellowing of mature leaves. The only means of mechanical transmission is by tissue transplantation. Cross-immunity tests were made to determine if the three diseases might be caused by different strains of the same virus, and the results of these tests are reported here. The rosette virus was found at all times readily to invade trees affected by yellows or little peach and to spread with about the same rapidity as in healthy trees. This is taken to indicate that there is no close relationship between rosette and either of the other two viruses. On the other hand trees affected with yellows proved immune to little peach and *vice versa*, and it is, therefore, concluded that these two diseases are closely related, and that little peach should in fact be regarded as a mild strain of yellows. Either of these viruses may apparently displace the other from infected buds. Thus yellows buds transplanted to little-peach trees produce shoots showing typical symptoms of little peach and *vice versa*. Sub-inoculations from these shoots transmit the disease carried by the tree into which the bud was inserted, and not the disease carried by the bud at the time it was transplanted. When buds affected with yellows and with little peach were inserted simultaneously in the stem of a healthy tree the shoots produced by both buds showed the symptoms borne by the bud in the upper position, thus indicating that the point of inoculation determines which virus will prevail in any given tree.

297. JONES, L. K., AND BAUR, K. E. 634.711-2.8

Mosaic and related diseases of raspberries in Washington.

Bull. Wash. St. agric. Exp. Sta. 324, 1936, pp. 19, bibl. 12.

Mosaic is the most serious virus-disease of raspberries in Washington. Leaf curl, yellow mosaic, and streak also occur, but are of minor importance. The symptoms of each are described. Observations on trial plantings and commercial fields indicate that the spread of mosaic is more rapid on black than on red raspberries. Of the red-raspberry varieties examined, Cuthbert and Marlboro are the most seriously damaged; Latham, Chief, Syracuse, Newburg and Antwerp are less affected; and Lloyd George is free from the disease. Of the black raspberries Plum Farmer and Munger are seriously damaged, and Cumberland, Dundee, Naples and Ohio are affected to a lesser extent. Considerable attention has been paid to roguing as a control measure, and trials have shown that the removal of infected plants with a healthy plant on either side may eradicate or materially reduce mosaic in treated areas. It is pointed out, however, that fields having much more than 5% of the plants diseased cannot be profitably rogued. Other control recommendations include the use of disease-free nursery stock, and of the less susceptible commercial varieties. Care should be taken to prevent the introduction of the aphid vector, *Amphorophora rubi*, into healthy plantings, and, where roguing is to be done, it should be completed during June before the aphids appear.

298. COOLEY, L. M. 634.711-2.8

The identity of raspberry mosaics.

Phytopathology, 1936, 26 : 44-56, bibl. 14, being *J. Pap. N.Y. St. agric. Exp. Sta.* 86, 1935.

Experimental transmission trials and field studies confirm Rankin's theory that only two viruses are involved in raspberry mosaics of eastern North America. It has been shown that the "mild mosaic" is caused by a virus identical to the red or red-raspberry mosaic virus. For purposes of simplification it is suggested that the name green mottle mosaic or green mosaic be substituted for the various terms at present used. The second virus is yellow mosaic, and for this no change is needed or advised.

299. SHAW, L. 632.314 : 634.11 + 634.13

Intercellular humidity in relation to fire-blight susceptibility in apple and pear.

Mem. Cornell agric. Exp. Sta. 181, 1935, pp. 40, bibl. 42.

The studies reported in this paper were undertaken with three objects :—1. To develop a method for measuring the relative humidity in the intercellular spaces of living plant tissue. Such a method has been evolved, and is based on measurements of the turgor deficit of the plant cells.

A table is given by which turgor-deficit values up to 96.5 atmospheres can be quickly converted to equivalent relative humidities. 2. To test the effect of relative humidity on the growth in culture of the fire-blight pathogen, *Erwinia amylovora*. The technique is described, and the results indicate that the maximum growth rate occurred at 99.9% relative humidity. At 99% the rate was approximately $\frac{1}{2}$ maximum, at 98% $\frac{1}{20}$ maximum, at 97% it was negligible or very slight, and at 96% and 95% no growth occurred. 3. To measure the relative humidity in the intercellular spaces and the fire-blight susceptibility of apple and pear tissues in environments differing in amount of moisture. When the moisture content of the environment was high, potted apple and pear plants showed high blight susceptibility and high intercellular humidity. A low moisture content resulted similarly in low susceptibility and low intercellular humidity. When the intercellular humidity was above 99.5% the plants were highly susceptible; when it was between 97 and 98.5% they were completely resistant or only slightly susceptible. The conclusion is expressed that intercellular humidity has a definite influence on the susceptibility of apples and pears to fire-blight, and that it is probably mainly responsible for differences in susceptibility shown by comparable groups of plants in environments differing in amount of moisture.

300. HILDEBRAND, A. A., AND KOCH, L. W. 632.4 : 634.75 + 633.71

A microscopical study of infection of the roots of strawberry and tobacco seedlings by micro-organisms of the soil.

Canad. J. Res., 1936, 14 : 11-26, bibl. 17.

The black root of strawberry and tobacco were co-operatively investigated and similar organisms, a list of which is given, were found in both hosts. The "phycomycetous mycorrhizal" fungus was particularly in evidence and it is thought from consistent morphological differences observed that several strains of this organism occur. The possibility that these differences may be due to the effect of the host on the fungus has not been lost sight of. From these and investigations on other varieties of plants the authors conclude (1) that a root rot as it occurs in nature is extremely complex even in cases where a primary causal agent is recognized and (2) that fungi representative of comparatively few groups or genera are "common factors" in root rot complexes of different host plants. The technique described allows of a study of the sequence and severity of infection by the organisms involved in a root rot complex, it reveals the occurrence of obligate parasites the presence of which would never be detected by other usual methods, and it may be adapted without difficulty to the study of other root rot complexes.

301. HENRICK, J. O.

634.711-2.4

Diseases of the raspberry.

Tasm. J. Agric., 1936, 7 (n.s.) : 36-8.

Four diseases are described briefly. 1. Mozaic (*sic*), a virus, for which control measures consist of removing diseased plants and all canes within 3 feet of these and of using clean nursery stock. 2. Anthracnose or cane canker caused by the fungus *Plectodiscella veneta* (*Gloeosporium venetum*). Control measures include thorough cultivation to keep down weeds and to clear away rubbish during the growing season and so prevent moist conditions around the canes, cutting out and burning all diseased canes after harvest and spraying with 4-4-50 bordeaux mixture, first when the buds are just bursting, again when the first leaves have formed, and thirdly just before blossoming. 3. A leaf spot, caused by *Phyllosticta* sp., may be controlled by the measures used for anthracnose. 4. Orange rust caused by *Gymnoconia interstitialis*, control of which is obtained by using healthy stock, careful inspection and roguing.

302. PITTMAN, H. A. J.

634.11-2.42

Black spot or scab of apples.

J. Dep. Agric. W. Aust., 1936, 13 : 20-9, bibl. 3.

The article is concerned with outbreaks of scab (*Venturia inaequalis*) in Western Australia, where until 1930 it was officially unknown. The prompt measures (described in full) taken then suppressed the disease until 1936 when it reappeared in an orchard about 5 miles distant from

the 1930 outbreak. No trace was found of it on the latter site which was at once examined. The economic importance of the disease is shown by conservative calculations, which estimate a loss of £20,000 annually to the apple industry of the State, should the disease ever become prevalent. The present outbreak probably originated in young trees imported from a neighbouring State where the disease has long been prevalent. The symptoms of the disease on leaf, fruit, blossom and twig are described under these headings.

303. MOORE, M. H. 634.11-2.42-1.8
Some observations on the influence of manurial dressings and of certain other factors on the incidence of scab (*Venturia inaequalis* (Cooke) Wint.) and of spray injury in apples.
J. Pomol., 1936, 14: 77-96, bibl. 4.

The incidence of apple scab on Bramley's Seedling and Worcester Pearmain is discussed in relation to manurial dressings, grassing-down, pruning and rootstock from data obtained over from one to five seasons. There are indications that nitrogenous manuring increased the tendency to scab while grassing-down decreased it. Weather conditions affect incidence since dry weather favours the beneficial action of the fungicides used against scab. Surveying rootstock influence alone both varieties were more susceptible to scab on Malling Nos. III, IV, VII, or X, than on I, II, V, or VI. (In other experiments the reaction of Cox's Orange Pippin was different.) Fruit russetting caused by bordeaux mixture applied at petal fall was more severe on trees receiving nitrogen than on those receiving potash, nitrogen and potash, or no manure. Trees on Nos. I, IV and V showed more russetting than trees on II, III, VI, VII or X.

304. FARISH, L. R., AND DUTTON, W. C. 634.11-2.42
Comparison of several materials for apple scab control in 1935.
Quart. Bull. Mich. agric. Exp. Sta., 1936, 18: 155-9.

Lime-sulphur, flotation sulphur, and "electric" sulphur were applied alone in various concentrations and together in different combinations and at different times to determine their effect in controlling apple scab. On the unsprayed check trees apple scab developed to a serious extent, but all spray treatments gave practically complete control. It is clear, therefore, that none of the concentrations used was sufficiently low to establish true comparative values. Both "electric" sulphur and flotation sulphur will, however, give satisfactory control of scab at concentrations as low as 6 lb. per 100 gallons, provided spraying is started before spore discharge begins, and is done very thoroughly and frequently enough to renew coverage. In commercial practice spraying may not be sufficiently thorough, and it is recommended that rather higher concentrations be used. Suggestions are made for several suitable spray schedules using the three sprays tested.

305. WILLISON, R. S. 634.25-2.42
Peach canker investigations. II. Infection studies.
Canad. J. Res., 1936, 14: 27-44, bibl. 63.

Part I (*Sci. Agric.*, 1933, 14: 32-47, *H.A.*, 1933, 3: 4: 498) dealt with incidence, contributing factors and control measures, and it was there pointed out that the disease was due to a fungus wound parasite. Three fungi are here discussed, of which *Valsa leucostoma* (Pers.) Fr. and *V. cincta* Fr. have been considered as the causal organisms of peach canker and certain forms of die-back, while *Sclerotinia fructicola* (Wint.) Rehm., the causal organism of brown rot of stone fruits, was also included. The investigations extended over a period of two years. *V. cincta* was found to be a virulent wound parasite able to infect freshly made wounds in autumn, winter and spring (but not in summer) and also to cause perennial cankers. *V. leucostoma* appeared incapable of initiating cankers on peach. *S. fructicola* produced considerable necrosis in the tissues of branches during the first 3 weeks after inoculation during the growing season but the lesions subsequently healed. During the dormant season the necrosis caused by *S. fructicola* was dependent upon certain conditions of humidity and temperature. It cannot be regarded as a cause of typical peach canker. Some factors influencing infection by the three organisms are discussed.

306. **BLODGETT, E. C.** 634.72-2.48
The anthracnose of currant and gooseberry caused by *Pseudopeziza ribis*.
Phytopathology, 1936, **26** : 115-52, bibl. 33.

A morphological and physiological study has been made of *Pseudopeziza ribis* Kleb., the fungus causing anthracnose of currants and gooseberries. Suspected host plants include about 25 species of *Ribes*, but apparently none outside this genus. The distribution of the fungus is practically world-wide. Investigations on its life history are reported. Spraying experiments were conducted 1932, 1933 and 1934. Bordeaux mixture, 3-4-50, gave satisfactory control when applied thoroughly:—(1) just before blossoming, (2) just after fruit set, (3) three weeks later, and (4) just after harvest. Lime-sulphur, 1-40, was less effective in the same programme, but controlled powdery mildew. Where both diseases were present, lime-sulphur used for the first two sprays and bordeaux for the later ones gave good control.

307. **FRYER, J. C. F., AND OTHERS.** 632.6/7
Report on insect pests of crops in England and Wales, 1932-1934.
Bull. Minist. Agric. Lond., **99**, 1936, pp. 50, bibl. 208.

The pests recorded on crops in the three years covered by this review are listed under the groups of plants concerned. These include fruit, vegetables, glasshouse vegetables, bulbs, flowers and willows. In addition, notes are provided on developments in methods of control, on introduced pests and on the more important pests of particular plants. The bibliography consists of 208 references to papers published in Great Britain and Ireland during 1932-4, which are concerned with subjects dealt with in the report.

308. **WILCOX, J., AND OTHERS.** 634.75-2.768
The root-weevils injurious to strawberries in Oregon.
Sta. Bull. Ore. agric. Exp. Sta. **330**, 1934,* pp. 109, bibl. 225.

Six species of strawberry root-weevils (3 belonging to the *Brachyrhinus* and 3 to the *Dyslobus* genus) have been found doing serious damage to strawberry plantations in Oregon. They are described and illustrated and their life histories are worked out. Many of them are parthenogenetic which accounts for the rapidity with which they can reproduce and become a serious pest. Of all the numerous control methods, which have been tried for over half a century, efficient cultural practices have hitherto proved the most useful. The system of poison baiting is now, however, becoming the accepted method. The baits are of two kinds—(1) 95 lb. of dried apple peelings mixed with 5 lb. of calcium arsenate or sodium fluosilicate, or (2) bran 50 lb., water 5 galls., sugar 10 lb., calcium arsenate or sodium fluosilicate (98% pure) 5 lbs. The sugar is dissolved in the water and the solution well mixed with the bran. When the bran is uniformly moistened, the powdered poison is added and thoroughly mixed in. One teaspoonful is placed in the crown of each plant and 100 lb. will bait from 1 to 3 acres. The apple peel bait is a patented product. The date of application is important. This is usually during berry harvest when the largest number of adults is active. An additional application is sometimes made in colder countries to deal with the overwintering adults. Attention is drawn to the comprehensive bibliography.

309. **FARRAR, M. D., AND OTHERS.** 634.11-2.9
Practical sanitation for apple orchards.
Circ. Ill. agric. Exp. Sta. **443**, 1936, pp. 23.

The greater part of this paper concerns sanitary measures to supplement spraying for codling-moth control. These consist of scraping trees to destroy hibernating places, repairing bad wounds, thorough pruning and the burning of prunings, cleaning up orchard debris, encouraging birds, the destruction of wormy fruit, the careful handling of cover crops and mulches to prevent them forming hibernating quarters, the use of chemically treated bands, guarding against packing shed infestations, dipping orchard crates before moths emerge in the spring, and finally

* Received May, 1936.

the prompt disposal of low-grade fruit. Sections are devoted to each of the above measures. Notes are also provided on orchard sanitation as related to wood borers, San José scale, tree hoppers, grasshoppers, the apple flea weevil, to rodents, and to apple scab, bitter rot, black rot and frog-eye leaf spot, blister canker, apple rust, and fire blight and blotch. As regards diseases, emphasis is laid on the clearing up of weeds and brush, which hinder the drying out of old leaves in the spring, and thus permit longer periods for spore discharge. In sod orchards the lower branches may with advantage be kept rather high to permit the free circulation of air under the trees.

310. VAN LEEUWEN, E. R. 632.78
Investigations of baits attractive to the codling moth.
Proc. Wash. St. hort. Ass. for 1935, 1936, 31: 136-9.

Work is in progress on the possible use of attractive baits to destroy the adult codling moth. Several thousand tests have been made, using about 250 materials and various combinations of materials. Some of these, when added to the standard molasses baits, have produced several hundred per cent. increases in the number of moths caught. In this paper the methods used are described briefly, and some of the more promising preliminary results are tabulated. The value of these baits as supplementary control measures have yet to be determined.

311. MARSHALL, J., AND GROVES, K. 632.78: 632.951.23
The present status of calcium arsenate in codling moth control.
Proc. Wash. St. hort. Ass. for 1935, 1936, 31: 142-50.

During the three years 1933-5 experiments have been in progress on the use of calcium arsenate for controlling codling moth. Many different mixtures have been tested in the field and in the laboratory. Of these a mixture consisting of calcium arsenate 4 lb., zinc sulphate (23% zinc) 1 lb., and calcium hydrate 2 lb. has given consistently satisfactory results for light infestations, and another consisting of calcium arsenate 4 lb. plus $\frac{1}{2}$ % medium grade highly refined petroleum oil emulsified with ammonium caseinate, with or without $\frac{1}{4}$ lb. zinc sulphate plus $\frac{1}{4}$ lb. calcium hydrate has given good results in the case of moderate infestations. A third mixture has shown promise for the control of very heavy infestations, but is still in the experimental stage. Some general notes on the uses and limitations of calcium arsenate are included. Used alone it causes injury and some other substances must be added. It should not, however, be combined with fish oils, vegetable oils, ordinary colloidal spreaders, ordinary soaps, hydrated lime alone, oleic acid, mineral oil emulsified with soap, or with mineral oil of low sulphonatable residue. The arsenic residue from calcium arsenate appears to be easier to remove than lead arsenate residue. Growers wishing to try calcium arsenate should do so very cautiously, trying it on only a small area at first. They need not expect that where lead arsenate has failed to control codling moth calcium arsenate will succeed.

312. BOYCE, A. M. 634.51-2.78
The codling moth in Persian walnuts.
 Reprinted from *J. econ. Ent.*, 1935, 28: 864-73, bibl. 8, being *Pap. Univ. Calif. Citrus Exp. Sta.* 326.

The codling moth, *Carpocapsa pomonella* Linn., is the major pest of the Persian or English walnut in California. The nature and degree of injury produced are described. By comparison with codling moth attack on pome fruits the problem of control is relatively simple owing to the inherent resistance of the host to entry by the larvae. The most effective spray appears to be basic lead arsenate, and under ordinary conditions one thorough application properly timed should afford adequate protection throughout the season. Spraying versus dusting, and experiences gained in the use of other spraying materials are discussed. Towers used for spraying mature trees 40-60 feet high are described, and mention is made of fermenting baits as an index of moth activity and the use of bands as a supplementary control to spraying or dusting.

313. ANON.

632.78

The codling moth.*Adv. Leaflet. Minist. Agric. Lond.* 42, revised 1935,* pp. 4.

The codling moth, *Cydia pomonella* L., and its life history are described briefly. For control the application of winter tar-distillate washes will clean the trees of moss and loose bark and reduce the cracks in which the larvae pupate. Spraying with lead arsenate at 4-5 lb. paste or 2-3 lb. powder per 100 galls. should be done just after the petals fall during the period of 7-14 days when the calyx cup is still open. Sack or corrugated paper bands, preferably two per tree, may be set in position during July and subsequently burnt with the cocoons during the autumn. Where spraying is impossible, fallen fruits should be collected and destroyed and rubbish near the trees collected and burnt. Dead wood may be cut out and loose bark and moss scraped off with advantage.

314. DAVIDSON, J.

632.73 : 634.11

The apple thrips (*Thrips imaginis* Bagnall) in South Australia.*J. Dep. Agric. S. Aust.*, 1936, 39 : 930-9, bibl. 6.

Following a severe outbreak of apple thrips in South Australia in 1931 this pest has been the subject of an extensive investigation and the present article reviews the position to date. The insect, its life history, host plants, and habits are described. Fluctuations in the numbers of thrips on roses have been shown by daily counts over four years. Increases in numbers occur in the autumn, the extent depending on favourable weather, and in two periods in the spring. The "first spring rise" is due to the emergence of adults from overwintering pupae and to the renewed activity of dormant adults. The "second spring rise" represents the appearance of a new generation. In the dry summer months the numbers of thrips declines. Weather conditions favouring an outbreak of economic importance in the spring are early autumn rains and a wet autumn, followed by an early and sustained warm spring. Among control measures so far tested, dusting the open blossoms with a mixture consisting of kaolin or talc 80-70%, finely ground derris 15-20%, and finely ground pyrethrum 5-10%, has given promising results. Derris and pyrethrum repel thrips, and the dust drives them out of the blossoms, and keeps them out during critical hot days. Sprays have so far given little success, but where growers desire to use one, a suggested formula is finely crushed derris root 2 lb., soap 5 lb., and water 100 galls. It is possible that spraying or dusting with the same mixtures may be of advantage when the buds are still unopened. It is also thought that spraying with a substance such as kaolin plus a spreader may form a temporary mechanical barrier over the openings into the buds, but both these treatments of unopened buds need further trial before recommendations can be made.

315. ANON.

634.726-2.793

The gooseberry sawfly.*Adv. Leaflet. Minist. Agric. Lond.* 30, revised 1935,† pp. 4.

The sawfly caterpillars most frequently damage gooseberry plants but they also attack red currants and more rarely black currants. The insect, its life history, and the injury it produces are described. Natural enemies exist in the form of several species of ichneumon fly, but alone do not exert a sufficient check. For control on a few bushes, hand-picking the leaves on which the eggs have been laid or the young caterpillars before they have scattered over the bushes is the simplest method. For treating larger areas spraying with a non-toxic insecticide such as derris powder 3-4 oz., soft soap $\frac{1}{2}$ -1 lb. per 10 galls. water is suggested. Lead arsenate may be used before the blossoms open or after the fruit is picked. Nicotine may be used to within 3 weeks of picking.

* First printed 1934.

† First printed 1933.

316. ROBINSON, R. H. 632.95

Sprays, their preparation and use.

Sta. Bull. Ore. agric. Exp. Sta. 336, 1935, pp. 30.

This paper provides growers with a useful guide to the preparation of a large number of sprays, including recommended combinations of insecticides and fungicides. At the end there is a compatibility chart which shows at a glance which materials may or may not be safely mixed in the spray tank.

317. TALBERT, T. J., AND OTHERS. 634.11-2.95

Missouri apple spraying : recommendations for 1936.

Circ. Mo. agric. Exp. Sta. 190, 1936, pp. 8.

The approved spraying programme consists of:—(1) Dormant or delayed dormant spray, chiefly for the control of San José scale, (2) pink or cluster bud spray against scab and black rot, (3) calyx or petal fall spray against scab, (4) 10-12 days later, first cover spray against scab and to build up a protective covering against codling moth, (5) 10-12 days later, second cover spray against scab, blotch and codling, (6) 10-12 days later, third cover spray against blotch and codling, (7) 10-12 days later, fourth spray against blotch or bitter rot and codling, (8) first half of July as for number 7, and (9) last half of July against codling moth. The principal materials are lime-sulphur and lead arsenate, and suitable mixtures of these and of other materials, which may be included when other pests and diseases occur, are given in each case.

318. TRUMBLE, R. E. 632.952.1

Recent lime-sulphur investigations.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 99-105, bibl. 16.

Recent investigations on lime-sulphur sprays and their uses are summarized. Evidence is put forward to show that the polysulphide sulphur content is the only constituent of any value in a lime-sulphur spray, and it is recommended that in diluting lime-sulphur solutions this content should be regarded as the basis. The thiosulphate sulphur content is of no value.

319. BACK, E. A., AND COTTON, R. T. 632.944

Industrial fumigation against insects.

Circ. U.S. Dep. Agric. 369, 1935, pp. 52.

This paper describes various methods by which products in storage, ranging from foodstuffs to furs and fabrics, or the establishments in which they are manufactured may be protected from insect attacks by the use of fumigants. Among points of horticultural interest it is noted that bagged nuts may be fumigated in atmospheric vaults with either ethylene oxide at 3 lb. per 1,000 cu. ft. space, or an ethylene oxide-carbon dioxide mixture at 25 lb. for exposures of 20-24 hours, or with $\frac{1}{2}$ lb. liquid hydrocyanic acid or its equivalent per 1,000 cu. ft. For vacuum fumigation ethylene oxide-carbon dioxide mixture at 30 lb. per 1,000 cu. ft. for 1-2 hours is satisfactory. A mixture of carbon disulphide and carbon dioxide is unsuitable for treating pecans, Brazil nuts and cashews. For dried fruits carbon disulphide at 20 lb. per 1,000 cu. ft. for 24 hours at a temperature of 70°F. or more is effective. Because of fire danger, however, it can only be used in isolated buildings. In stores, etc., not isolated, ethylene oxide at 2 lb. or the ethylene oxide-carbon dioxide mixture at 20 lb. per 1,000 cu. ft. for 24 hours should be substituted. Hydrocyanic acid at a rate of 1 lb. liquid per 1,000 cu. ft. can be used in airtight vaults. Where the finished package is to be fumigated prior to shipping, fumigation with the ethylene oxide-carbon dioxide mixture as for nuts may be used. Notes are supplied on safe-guards to be employed in fumigating, and on first aid for hydrocyanic acid gas poisoning.

320. PEARCE, G. W., AND OTHERS. 632.951.23

A chemical method for determining the safeness to foliage of commercial calcium arsenates.

Tech. Bull. N.Y. St. agric. Exp. Sta. 234, 1935, pp. 15, bibl. 11.

Commercial calcium arsenates may be divided into the following three groups according to the amount of injury they cause to foliage:—Safe brands, causing little or no injury except under

extreme conditions of temperature and humidity ; intermediate, causing moderate injury under most conditions ; unsafe, causing pronounced injury under most conditions. No correlation has been found between the gross chemical composition and the amount of injury, nor does the water-soluble arsenic as determined by the official method provide a true index of effect. In experiments described in this paper it was found that if the free lime normally occurring in calcium arsenates is removed by any of several means, then the water-soluble arsenic content becomes a true measure of safeness. Of the methods tried, that preferred was the use of carbon dioxide under specific conditions to remove the free lime. In a number of representative commercial preparations the water-soluble arsenic content determined by this method was found to vary from 0.20% to 11.50% As_2O_5 . 0.75% As_2O_5 is taken as the upper limit for safe calcium arsenates and 2.50% for intermediate types. From the results of these experiments it seems evident that the presence of highly soluble salts of calcium and arsenic is mainly responsible for injury rather than the deterioration of the product as a whole caused by carbon dioxide. The evidence all points to dicalcium arsenate as the compound which makes certain brands unsafe.

321. COLE, C. E.

632.951.23

Arsenical spray residue on fruit. Recommendations for its removal.*J. Dep. Agric. Vict.*, 1936, 34 : 22-7.

Practical recommendations are made for the removal of arsenical spray residues on apples and pears. Among these are the following :—Washing is quicker, more effective and cheaper than wiping. Trials in Victoria have not revealed any washing solution superior to hydrochloric acid of s.g. 1.2, and this may be used between the limits of 1% for 2 minutes and 4% for 4 minutes, a good standard being 3% for 2 minutes. Factors affecting ease of removal are amount of residue, the presence of oil especially in late sprays, and the waxiness of the fruit. Washing should be done immediately after picking, because the wax on the skin increases with keeping, removal from store to wash increases handling costs, and thirdly because washing stored fruit may reduce the temperature of the wash to a point at which it becomes ineffective. The acid gradually loses strength and should be changed completely after washing 1,000 cases per 100 galls. solution. Apples, particularly those with open calyx tubes such as Delicious, Five Crown, and Cleopatra, should not be immersed deeper than 6" to prevent acid being forced into the core and causing injury. Pears may be submerged to any depth. Thorough rinsing, preferably in constantly-changing water, is essential. Where running water is not available, lime should be added to the rinse bath, and the water should be completely changed at the same time as the acid. Drying is unnecessary, and the fruit can be stored or packed immediately. A plant, suitable for hand washing and costing not more than £20, is described with the aid of a diagram, and a suggested routine for washing outlined.

322. OVERLEY, F. L., AND OTHERS.

632.951.23

Residue removal studies, the experimental spray programs.*Proc. Wash. St. hort. Ass. for 1935, 1936*, 31 : 160-2.

Experiments have shown that where apples are sprayed with lead arsenate with or without materials containing calcium and are harvested before they accumulate much wax, the most effective wash is hydrochloric acid (HCl), especially when a mineral oil is added. Where the fruit has been heavily sprayed with lead arsenate, mineral oil, oleic acid and soap, the residue is satisfactorily removed using sodium silicate and hydrochloric acid in-tandem washers. Mineral oil added to one of the solutions again improved cleaning. Fruit sprayed with a mixture containing calcium arsenate, zinc sulphate and calcium hydrate was cleaned successfully with HCl in an overhead flood type washer, the addition of mineral oil producing little, if any, improvement. The addition of 2 quarts mineral oil to the calcium arsenate spray, especially where zinc sulphate and calcium hydrate were omitted, made residue removal more difficult. Success was, however, readily obtained with the tandem washer, namely sodium silicate followed by HCl. Sodium silicate alone was unsatisfactory with any of the calcium arsenate sprays. For fluorine-oil residues

HCl used in an overhead flood, underbrush, washing machine was the most effective single wash. With heavy residues the best results were obtained from tandem machines with both HCl and sodium silicate.

323. ROBINSON, R. H., AND HATCH, M. B. 634.1/8-2.95
Spray residue information for the orchardist and fruit packer.
Sta. Bull. Ore. agric. Exp. Sta. **341**, 1935, pp. 22.

In this paper the authors sum up the information obtained from experiments and from experience on the removal of lead and arsenical residues on apples and pears by the use of hydrochloric acid, sodium silicate and their combinations. The headings of the principal sections are as follows:—Factors that complicate the removal of spray residue.—Washing solvents and their combinations.—Washing equipment.—Suggested procedures for the operation of washing equipment.—Information on the operation of the home-made flotation washer by the small orchardist.—Procedure for operation of the flotation machine.—Method for the determination of acid strength and description of the operation.—Method for the determination of sodium silicate.

324. GROVES, K., AND MARSHALL, J. 634.11-2.95
The determination of spray coverage on apples.
J. agric. Res., 1935, **51**: 1139-42, bibl. 6 in text.

Comparisons of the weights of material used per 100 gallons of water in sprays cannot be regarded as reliable for comparisons of control, because they make no allowance for coverage per unit area of fruit. This paper describes methods used at the Washington Experiment Station for determining arsenical deposits on apples. The average coverage on the surface of the fruit does not give an accurate indication of effectiveness, because deposits in the calyx and stem ends are usually considerably higher than deposits on the check surface. The chief difficulty in determining coverage is the estimation of the surface area of apples. Some types may be regarded as spheres, but for certain varieties, such as Jonathan and Winesap, a better approximation is to calculate the area of the surface of revolution of a cardioid about its axis of symmetry, $p=a(1-\cos \theta)$, which is approximately $20.1a^2$. a is determined from the measurements of the apple by multiplying the diameter perpendicular to the core by 0.385, and the diameter parallel to the core by 0.444. In analysing the arsenic deposit the stem and calyx ends may be removed with a cork borer, and the area removed deducted from the total area. A simpler method of determining coverage is to cut a number of discs from the fruit with a cork borer. Regarding the fruit as a sphere the area of a disc removed equals $2\pi R(R - \sqrt{R^2 - r^2})$, where R is the radius of the apple and r the radius of the disc. A satisfactory size of sample proved to be 12 apples from each experimental plot and 6 or more discs cut from each apple. Coverage determined by this method correlated unusually well with control on arsenical sprayed plots. For analysis the bromate method was found to be more suitable than the Gutzeit method, on account of the relatively large deposits to be measured.

325. KARR, E. H. 632.951
Discussion on the residue removal of fluorine sprays.
Proc. Wash. St. hort. Ass. for 1935, 1936, **31**: 119-26.

The use of natural cryolite sprays for the control of codling moth produces on apples fluorine residues which are more difficult to remove than equivalent amounts of lead arsenate. Recent information obtained on the problem is discussed here. Up to the present hydrochloric acid diluted to 1-2%, commonly 1.5%, has proved the most satisfactory washing material. For heavy fluorine deposits, however, it is essential to use tandem washing procedures, in which an alkaline wash, preferably sodium silicate at 60-80 lb. per 100 galls., precedes the hydrochloric acid wash. The principal function of the sodium silicate is to remove waxy substances, fish oil, or soap residues that tend to bind the cryolite to the surface of the fruit. The type of washing machine is very important, because successful removal depends more on physical than chemical actions. Several types of washing equipment are suitable for fruit, which has not received more

than three applications of cryolite during the latter part of the season. Of these the most satisfactory is an experimental, tandem fruit washing machine, and the construction of this is described in some detail with the aid of a diagram.

326. SMITH, E., AND OTHERS.

632.951.8

The use of low viscosity mineral oils in spray residue control.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 157-9.

Experiments were made to determine the use of low viscosity mineral oils as an aid to the removal of lead arsenate residues on apples. 1% of oil by volume, when added to sodium silicate and to hydrochloric acid at temperatures of 100°F. or over in a dual process washer, was found to increase the effectiveness of both washes, but more particularly the acid wash. It was also discovered that a heated oil and water wash was more effective than sodium silicate alone, and was as good as sodium silicate plus oil, when all were followed by the acid wash. In single process flood machines a mineral oil of 30 seconds Saybolt viscosity was slightly more effective when used with acid than an oil of 45 seconds Saybolt viscosity. It was neither necessary nor desirable to emulsify the oil with blood albumin. The oil washes proved most effective in cleaning fruit which had been sprayed with a mineral oil. The temperature of the wash could safely be raised by 5-10°F. when oil was added. Rinsing, preferably with warm water, must, however, be very thorough where oil is used in the wash. Apples cleansed in this way tend to lose excessive moisture after washing, if temperatures are high and relative humidities low, and it is recommended that they should be placed in cold store as soon as possible. Mineral oil should not be used in washing pears.

VEGETABLE GROWING.*

327. DUNLAP, A. A.

631.531 : 632.41

Seedling culture in sand to prevent damping-off.

Phytopathology, 1936, 26 : 278-84.

Seedlings of many species of vegetables and flowering plants have been raised successfully in a brown sea sand with a water-holding capacity of about 24% when nutrients were added in solution. This method has eliminated most of the pre-emergence and post-emergence damping-off and has given increases of from 12-100% success over comparable seedlings in soil. The type of nutrient solution is comparatively unimportant so long as suitable amounts of nitrogen and potassium are present. In fact a 2-salt solution would probably be quite adequate to grow the plants through the seedling stage. In germination and in subsequent development seedlings grown in sand compared favourably with seedlings grown in soil cultures. The percentage survival of seedlings transplanted from sand into soil was also equal to that of comparable seedlings from soil. Finally the growing of seedlings in sand simplifies certain cultural operations. For example, less care is needed in watering and transplanting is made easier. The sand may be used indefinitely, for if it is washed in hot water there is no increased danger of damping-off.

328. HUTCHINS, A. E., AND SANDO, L.

633.8

Herbs. Their culture and uses.

Minn. Hort., 1936, 64 : 3-4, 31-2, 48-50, 69-70.

For the purpose of this article herbs are defined as those plants which possess aromatic or healing properties and are used for medicinal, perfuming or flavouring purposes. Some also possess a definite ornamental value. General principles of cultivation and propagation are discussed, and short descriptions are given of more than 40 species which should grow well in Minnesota. Most of them are known in England. The origin, uses and cultivation of each species are described briefly.

* See also 245, 402, 403, 404.

329. HAWTHORN, L. R. 635.1/7

Vegetable varieties for the Winter Garden region of Texas.

Bull. Tex. agric. Exp. Sta. 508, 1935, pp. 139, bibl. 32.

Descriptions are given of the principal varieties of 49 different vegetables. In the great majority of cases these are taken from an extensive series of vegetable adaptability trials started in 1930 at the Winter Garden Experiment Station, Texas. In the case of tomatoes, spinach, beets and onions use has also been made of descriptive material obtained in co-operative studies by the U.S. Bureau of Plant Industry. Diseases and pests, in addition to questions of climate, soil and cultivation, are dealt with under the general heading of adaptability. The resistance of certain vegetables to cold injury during 1933, when the temperature fell to 18°F., is also stated.

330. LLOYD, J. W., AND LEWIS, E. P. 635.1/7 : 631.8

Substitution of commercial fertilizers for manure in vegetable production.

Bull. Ill. agric. Exp. Sta., 421, 1935, pp. 579-610.

The manurial trials described here were carried out in Cook County, Illinois, over a period of eight years using ten vegetable crops. Five of these, spinach, lettuce, beets, peas and beans, matured early. These were followed by a cover crop of rye and vetch, which was ploughed under the following May, about two weeks before a second series of five late maturing crops, tomatoes, peppers, carrots, potatoes and cauliflower, were planted. In this way, the two series of early and late crops were rotated, and organic matter was supplied in alternate years. Treatments consisted of various combinations of manure and artificial fertilizers and check plots receiving no fertilizer of any kind. The yields are tabulated, and indicate that in this area the scarcity and high price of manure need not seriously affect the yields of these crops. The use of complete fertilizer dressings in place of all manure sometimes produced rather smaller yields, but in most cases these were more economical than yields obtained from manured plots. Incomplete fertilizers gave lower yields than complete when no manure was included. Replacement of half the manure by commercial fertilizers resulted in higher yields than for full manure alone, and for this purpose superphosphate was just as effective as complete fertilizer in most cases. Nitrogen alone proved unprofitable in these trials, but gave good results when combined with phosphates. Most crops responded slightly to applications of limestone.

331. ANON. 632.451 : 635.25

Onion and leek smut.

Adv. Leaflet. Minist. Agric., Lond. 261^a, 1936, pp. 6.

Onion smut, caused by the fungus *Urocystis Cepulae* Frost is a notifiable disease. Its symptoms, mode of infection and means of dissemination are described. Preventive measures include the collection and burning of all diseased seedlings and plants. A special licence is required to grow onions or leeks in soil which has carried a smutted crop. Trials have shown that smut cannot be exterminated in practice by soil disinfection. The use of dilute formalin (40% formaldehyde) has, however, enabled reasonable stands of healthy seedlings to be raised in contaminated soil. Legislative measures are in force to regulate the importation of onion plants or "sets".

332. ANON. 632.753 : 635.34

The cabbage aphid.

Adv. Leaflet. Minist. Agric. Lond., 269, 1936, pp. 3.

The cabbage aphid, *Brevicoryne brassicae*, in some seasons causes serious losses to growers of brussels sprouts, cabbages and similar vegetables. The life history of the insect and the damage it does are described briefly. The number of aphides is lowest in February and subsequent increases depend on the presence of suitable plants. All old plants should be ploughed under not later than May 15th, or collected in heaps and burnt or turned so as to dry

* Formerly leaflet 365.

out the stumps. Crops held for seed should be sprayed with nicotine wash (98% nicotine 3 oz., soft soap 4 lb., water 40 gals.) during mid-May, or dusted, probably twice, with a 3% nicotine dust. Autumn sown plants should be examined before planting out, and, if aphides are seen, should be dipped in the nicotine spray fluid. New crops infected during June or July may be dusted with 3% nicotine at 40 lb. or more per acre. Local authorities in certain counties are entitled to enforce spring treatment of *brassica* crops which appear likely to serve as centres of infection.

333. BRIAN, P. W.

635.52

Varieties of cabbage lettuce and their classification.*J. Pomol.* 1936, 14: 26-38, bibl. 7.

The need for a classification of cabbage lettuce and a determination of synonyms became apparent during the study of a severe mosaic disease, susceptibility to which varied greatly among different varieties. None of the earlier attempts at classification fully meets the case, since most of them, being based on season and method of cultivation or outward characters, often end in the splitting of closely related groups. The value of certain characters as a means of classification are examined. These are seed colour, pigmentation, colour of leaves, leaf texture, length of time before flowering, shape of heart. Of these leaf texture, which may be (a) crisp or (b) leathery or slightly greasy, is of major classificatory importance in dividing lettuce into two distinct, larger groups. A table is given showing the classificatory value of the characters. A number of distinct varieties of lettuce is arranged in their natural groups with a list of five distinguishing characters for each variety. The characters, however, can only be used for the differentiation of varieties within a group. It is important to note that, not only are synonyms frequent among lettuce varieties, but that *per contra* different seedsmen's strains of the same lettuce may be appreciably different. The paper ends with a classified descriptive list of a number of cabbage lettuce varieties grown in England.

334. MUNSELL, H. E., AND KENNEDY, M. H.

635.52 : 577.16

The vitamin A, B, C, D, and G content of the outer green leaves and the inner bleached leaves of Iceberg lettuce.*J. agric. Res.*, 1925, 51: 1041-6, bibl. 7.

The tests were undertaken to determine the relative vitamin potency of the green and bleached leaves of Iceberg lettuce, *Lactuca sativa* var., grown in California. The technique is described in each case and the results tabulated. The green leaves were found to be about 34.5 times as rich in vitamin A as the bleached leaves. Estimates for vitamin B were made with rats from two different colonies, and in both cases the green leaves proved somewhat less rich than the bleached. The ratios of potency were 0.80 and 0.69 for the two colonies respectively. The vitamin C tests were made by feeding different amounts of lettuce daily to guinea pigs. The results indicate that the minimum protective dose of bleached leaves is about 21 grams, and of green leaves slightly over 21 grams per day. In the vitamin D tests rats which had developed severe rickets were fed daily with amounts of lettuce up to 5 grams. No healing was produced, and this would appear to prove that neither green nor bleached lettuce leaves contain detectable amounts of vitamin D. In vitamin G tests very different results were obtained with rats from two colonies, but the ratios between green and bleached leaves were similar, namely 1.91 and 1.76 respectively.

335. NELSON, R., AND COCHRAN, L. C.

635.53 : 632.48

Copper dusts control celery early blight.*Quart. Bull. Mich. agric. Exp. Sta.*, 1936, 18: 163-9.

Early blight of celery in Michigan is caused by *Cercospora Apii*, and late (black) blight diseases by *Septoria Apii* and *S. Apii* v. *graveolentis*. An epidemic of early blight in 1935 led to the experiments in control described here. From the results of these the following recommendations are made:—(1) The fungi are seed-borne, and the seed should be immersed in a bag in lukewarm water for 30 minutes, followed by immersion in a 1 in 1,000 solution of corrosive sublimate

for a further 30 minutes. It should then be rinsed, thoroughly dried and sown as soon as possible, a rather heavier rate of seeding being used to compensate for somewhat reduced germination due to treatment. (2) Dust the seedlings with copper-lime, or spray with bordeaux mixture 4-5 times, beginning when the plants are about 1" tall, and on transplanting immerse the tops in bordeaux mixture. (3) Dust or spray the plants in the field 5-10 times at 7-10 day intervals, preferably before rains or irrigating. (4) Irrigate so as to avoid leaving the plants wet at night. A good rule is to apply water when the temperature is rising, never when it is falling.

336. ANON. 635.1/7 : 632.42

The Sclerotinia disease of potatoes and other plants.

Adv. Leaflet. Minist. Agric., Lond., 265, 1936, pp. 4.*

The leaflet describes *Sclerotinia sclerotiorum*, its methods of infection and control measures with particular reference to potatoes. The fungus also attacks many other cultivated plants, notably tomato, artichoke, sunflower, paeony, bean, marrow, cucumber, and in storage during the winter carrot, turnip, and again artichoke. In 1935 an attack on hops was recorded. Brief notes are supplied on the control of *Sclerotinia* on these plants.

337. MULLENDORE, N. 635.31

Anatomy of the seedling of *Asparagus officinalis*.

Bot. Gaz., 1935, 97 : 356-75, figs. 44, bibl. 17, being Contr. Hull. bot. Lab., 466.

Descriptions are given of the structure of the embryo and of the processes of development of the seedling of *Asparagus officinalis* L.

338. JONES, H. A., AND OTHERS. 635.35

The cauliflower industry of California.

Circ. Calif. agric. ext. Serv., 93, 1935, pp. 32, bibl. in text.

From 1921 to 1933 71.73% of the total carlot movements of cauliflower in the U.S. originated in California. Production areas and seasonal shipments are tabulated. An outline is given of climatic and soil requirements, of cultivation from seed bed to harvest, of irrigation, crop rotation, intercropping and manuring. Rigid grading is necessary, because there is very little demand for inferior products. Conditions associated with inferior quality are over-maturity, "riciness", "fuzziness", leafy curds, small sizes, yellowing of leaves, discoloration of curds and insect injury. The U.S. standards for cauliflower are given. Notes are supplied on the following insect pests and their control:—the cabbage aphid, the common cabbage worm, the cabbage looper, the diamond-back moth, and the harlequin cabbage bug. Diseases include damping-off, brown rot, downy mildew, root rot, mosaic and ringspot.

339. WALLACE, J. C. 635.54

Cultivation of chicory as a vegetable.

J. Minist. Agric., Lond., 1936, 43 : 135-40.

There is a limited demand for forced chicory, most of which is imported from Belgium. It is shown here that it can be successfully cultivated in England in outdoor pits, the necessary temperature being obtained by a covering of farmyard manure without elaborate forcing plant. The crop is expensive to produce and heavy importations may reduce the return below the cost of production, as happened in 1934-5. The instructions for cultivation given in the article are based on experience obtained with the crop at the Kirton Agricultural Institute since 1932.

* Formerly leaflet 127.

340. COCHRAN, H. L. 635.56
Morphology of an internal type of abnormality in the fruit of the pepper.
Bot. Gaz., 1935, **97** : 408-15, figs. 14, bibl. 20, being *Contr. Dep. Veg. Crops*,
Cornell Univ., **123**.

An internal form of abnormality occurs rather frequently in the fruit of the pepper, *Capsicum frutescens* L. A morphological study of the abnormality has been undertaken and is here reported. None of the observations made, however, explains definitely what factors cause the phenomenon, but it is pointed out that, as affected fruits for the most part develop parthenocarpically, the same factor or factors may be responsible for the sterile, seedless condition and the development of the abnormal structure. Evidence from other sources is discussed, which suggests that hybridity and vegetative vigour as influenced by environmental conditions may be involved.

341. YOUNG, P. A. 635.62 : 632.41
***Sclerotinia* rot of squash and pumpkin.**
Phytopathology, 1936, **26** : 184-90, bibl. 23.

A long list of the known hosts of *Sclerotinia sclerotiorum* is given with citations. Economic host plants liable to serious attack by this fungus in Montana are also reported. In experiments *S. sclerotiorum* was found to cause a wet rot of pumpkin fruits, *Cucurbita Pepo* L., and a dry rot of squash fruits, *C. maxima* Dach. The fungus isolated from naturally infected fruits and inoculated into healthy pumpkins and squashes caused the typical rots.

342. BUTLER, L. 635.64 : 575.1
Inherited characters in the tomato. 2—Jointless pedicel.
J. Hered., 1936, **27** : 25-6, bibl. 2.

In all common tomato varieties the pedicels are geniculate, having a swollen abscission joint midway between the peduncle and calyx. When the fruit is picked, this joint usually forms the point of detachment, the calyx and half of the pedicel coming away with the fruit. Fruits from certain tomato crosses were noted, however, to be attached to jointless pedicels, and in picking the calyxes remained on the plant. This character was found to be a simple recessive derived from the French parent variety Rouge naine hative. Subsequent breeding studies showed that a close link existed between this character and the leafy-inflorescence in the fifth chromosome. The exact relationship between the jointless pedicel and three other characters in the fifth chromosome has not yet been established.

343. PORTE, W. S., AND OTHERS. 635.64
The Glovel tomato.
Circ. U.S. Dep. Agric., **388**, 1936, pp. 5.

The Glovel tomato is a new variety with the same parentage as Marglobe, i.e. Globe × Marvel. The main purpose in developing the Glovel variety was to obtain a scarlet-red (pink) fruited type with the resistance of Marvel to *Fusarium* wilt and to the nailhead rust combined with the fruit qualities of Globe. The Glovel plant and fruit are described in detail. Tests made during the past four years with special reference to the winter tomato growing area of Florida have shown it to be well adapted for use as a shipping tomato, especially in districts subject to outbreaks of disease.

344. SMALL, T. 635.64 : 632.42
Diseases of outdoor-grown tomatoes in Jersey.*
J. Minist. Agric., Lond., 1936, **43** : 117-24.

The diseases dealt with are *Phytophthora infestans* (blight), *Didymella Lycopersici* (stem rot), *Phytophthora* causing damping off, *Corticium Solani* (root rot), *Cladosporium fulvum* (leaf mould), *Verticillium albo-atrum* (verticillium wilt), *Botrytis cinerea* (grey mould) and root

* See also 403.

knot, caused by the soil pest *Heterodera marioni*. Less important diseases i.e. those that have not obtained strong foothold in Jersey are *Septoria Lycopersici* (leaf spot), *Macrosporium Solani* (target spot), *Sclerotinia sclerotiorum* (Sclerotinia disease), root rots caused by *Thielaviopsis basicola* and *Colletotrichum atramentarium* and fruit rots *Pleospora herbarum*, *Alternaria tenuis* and *Fusarium Equiseti*. Virus diseases are not important. Control measures are discussed.

345. ANON.

635.64 : 632.48

Tomato leaf mould.

Adv. Leaf. Minist. Agric., Lond., 263, 1936, pp. 4.

A brief description is given of the disease, which is caused by *Cladosporium fulvum*, and of conditions of temperature and humidity which favour its development. Control measures are dealt with under four headings:—(1) Starting with a clean house. The remains of a diseased crop should be burnt, and the house disinfected by spraying with an emulsion of cresylic acid and soft soap. (2) Temperature should, if possible, be kept below 70°F. and humidity below 70%. Ample ventilation at all times is of great importance. (3) If the disease becomes established, direct treatment at intervals will be necessary, (a) vaporizing with sulphur, (b) dusting with sulphur, or (c) spraying with liver of sulphur, ammonium polysulphide solution, or lime-sulphur. (4) Certain varieties, such as Up-to-Date and Stirling Castle, show considerable resistance to leaf mould, but may not be commercially satisfactory in other respects.

346. SEATON, H. L., AND GRAY, G. F.

635.64 : 632.19

Histological study of tissues from greenhouse tomatoes affected by blotchy ripening.

J. agric. Res., 1936, 52 : 217-24, bibl. 12.

The presence of red and colourless markings, commonly called blotchy ripening, which impairs the appearance and quality of glasshouse tomatoes, is the subject of an investigation at the Michigan Agricultural Experiment Station. The results of a histological study which forms part of this investigation are presented here. Anatomical examination has shown that the disorder is in all cases associated with the break-down of the parenchyma cells of the fleshy layer of the fruit wall. The vascular bundles are not involved in the discoloration of the tissues, but the break-down of parenchymatous cells near and adjacent to the bundles severs the connections of the outlying cells for the transfer of elaborated materials and water, and thus inhibits normal ripening in the blotchy areas. The histological studies as well as data from other investigations on the disorder substantiate an earlier hypothesis, that blotchy ripening is due primarily to conditions resulting from the withdrawal of water from the fruit during periods of excessive transpiration occurring 2-5 days before the fruit ripens. They also indicate that deficiencies of potassium and nitrogen, as suggested by other workers, are probably secondary and occasional factors.

347. OGILVIE, L.

635.64 : 632.8

A note on the occurrence of new virus diseases of the tomato in the Bristol province.

J. Bath W. S. Co. Ass., 1935-6, 10 (ser. 6) : 204-6, bibl. 4.

Two virus diseases of tomato both found for the first time in 1935 in the Bristol area are described (Not spotted wilt.) The symptoms of No. 1 are an almost complete cessation of growth in rather mature plants, with a bright yellow mottling of the upper leaves and the lower ones chlorotic and showing a tendency to drop off. The most characteristic feature is the blue or purplish coloration of the entire foliage. The fruits were markedly blotched or mottled. The virus is definitely new to science and is not closely related to other known tobacco viruses. It is readily transmitted by rubbing. In No. 2 the leaves of young affected plants have a faint greyish tint with clearly defined mottled areas of yellowish white and dark green, more pronounced than in ordinary tomato mosaic but less bright than characteristic *Aucuba* mosaic. Infection occurring on maturer plants causes the lower leaves to turn yellow, beginning at the

edges with inward progression until only the midribs remain green. Complete side branches may yellow and wilt, and often the progression continues up the plant until finally growth ceases and the plant dies. Wilted leaves often show purplish edges and the fruit is often mottled and necrotic. The most striking feature of this disease is the progressive yellowing of the leaves from base to tip. The virus belongs to the tobacco virus group, but biological details are still lacking. The grower is warned against mistaking the symptoms of either of these diseases for those caused by cultural inefficiency. Tomato virus diseases can be transmitted through tobacco, 23 out of 26 samples of cigarettes and other tobacco having been found virus infected in a recent test at Cheshunt Research Station. Smoking should be prohibited while plants are being handled, and before touching plants workers should wash their hands in soap and water, a practice which has been found to remove contamination effectively.

348. ANON. 35.65

The culture of green peas and beans.

Adv. Leaf. Minist. Agric., Lond., 152, revised 1936,* pp. 4.

Brief notes on the cultivation and manuring of peas, broad beans, dwarf, kidney or French beans, and runner beans.

349. WALTON, C. L., AND OTHERS. 632.651.3 : 635.656 + 633.491

The effect of calcium cyanamide on pea and potato sickness.

J. Bath W. S. Co. Ass., 1935-6, 10 (ser. 6) : 187-93, bibl. 9.

Applications of calcium cyanamide at the rate of 10 cwt. per acre resulted in normal crops of peas and potatoes on eelworm infested land in Somerset and Gloucestershire, whereas the control crops were subnormal. As usual in similar experiments the cyst numbers on the roots were not appreciably reduced by the applications. The good effects are considered to arise more from the supplying of nitrogen to "sick" plants than from any lethal effect on the eelworms.

350. BOND, T. E. T. 631.541 : 632.42

***Phytophthora infestans* (Mont.) de Bary and *Cladosporium fulvum* Cooke on varieties of tomato and potato and on grafted solanaceous plants.**

Ann. appl. Biol., 1936, 23 : 11-29, bibl. 45.

In preliminary inoculation experiments the eight varieties of potato tested proved equally susceptible to *Phytophthora infestans*, but only certain of twelve tomato varieties were definitely susceptible. Similar experiments with *Cladosporium fulvum* revealed well marked differences in susceptibility among the tomato varieties. This fungus appears to be strongly specialized to the tomato, *Lycopersicum esculentum*, and the currant tomato, *L. racemigerum* Lange or *L. pimpinellifolium* Dun., proved immune. In the grafting experiments some fifty combinations of tomatoes, potatoes, *Solanum nigrum*, *Atropa Belladonna* and *Datura Stramonium* were produced. Inoculations made, in most cases, after new growth had developed from stock and scion, gave results, which, without exception, were identical with those obtained on ungrafted material, both stock and scion retaining their characteristic reaction to infection unaltered. From this it is concluded that, although negative results cannot be conclusive in themselves, they indicate that resistance or susceptibility are either genotypic properties of the protoplasm or are due to some factor that is not, as such, transmissible from stock to scion or *vice versa*. The techniques used in the inoculation and grafting experiments are described.

351. YOUNG, P. A. 632.951.8

Distribution and effect of petroleum oils and kerosenes in potato, cucumber, turnip, barley and onion.

J. agric. Res., 1935, 51 : 925-34, bibl. 17.

The object of the experiments described here was to determine the distribution and effect of petroleum oils in species of herbaceous plants treated with sprays of undiluted lubricating

* First printed 1933.

oils or kerosenes. The effect of different sprays on potato leaves was particularly noted and results are recorded and tabulated. The toxicity of oils may be tested before spraying by placing drops of each oil, and drops of unsulphonatable oil, on healthy leaves, and observing the comparative symptoms. Where more than a few necrotic symptoms appear within a few days the oil is probably too toxic for commercial spraying. Only slight injuries were usually caused by oils and kerosenes with low percentages of sulphonatable residues. The distribution of oils in potatoes and other plants was studied mainly with the help of oil Red O stain, which did not appear to affect the toxicity of the oils 3 and 24, with which it was used. Sections showed that the petroleum oils passed from the leaves into the roots. Conduction takes place mainly in the intercellular spaces between the parenchyma cells but oil globules were also found inside tracheae and parenchyma cells.

352. BALL, W. E., AND FRENCH, O. C.

632.954

Sulfuric acid for control of weeds.

Bull. Calif. agric. Exp. Sta., 596, 1935, pp. 29, bibl. in text.

The greater part of this paper is concerned with the use of sulphuric acid in controlling weeds among cereals, but an experiment is described in which onions, heavily infested with knotgrass, *Polygonum aviculare*, were treated. 10% of acid by weight was applied when the crop was young with a knapsack sprayer with very successful results. The onions were badly scorched, but recovered completely within a fortnight. Later in the season an application was made with a power sprayer, but, as this failed to control the weeds completely and apparently did more damage to the crop, it is thought that spraying should be done only when both the onions and the weeds are young. The addition of a spreader to the acid did not enhance the value of the treatment appreciably. The total cost of an application to a grain field is given as approximately \$3.00 per acre. A suitable equipment for applying dilute sulphuric acid has been evolved and is described.

FLOWER GROWING.

353. ANON.

633.812

Lavender : its cultivation for marketing and distilling.

Adv. Leaflet. Minist. Agric., Lond., 264, 1936, pp. 4, bibl. 4 in text.

Lavandula vera is the species of lavender grown in England. It requires very little moisture, and the soil should be calcareous, stony and well-drained, the ideal being a light brown loam overlying chalk. The site should be as free from frost as possible and well exposed to the sun. Propagation is by cuttings taken in early spring and struck in sheltered beds in the open or in a cold frame or glasshouse. Shoots 6-9" long are usually selected, but to avoid shab disease cuttings 2-3" long consisting of green wood may be used. In preparation for planting deep and thorough cultivation is necessary. Spacing is usually 18" x 18", alternate plants being removed after one year to leave plants 36" x 36". Wider initial planting may be necessary if shab disease is prevalent. October and early spring are the best times for planting. The rooted cuttings should be planted very deeply, leaving only about 2" of the top above soil. In commercial practice the bushes are seldom kept after their fifth year. Cutting the crop, marketing and distilling are described briefly. An outline is given of shab disease, caused by *Phoma Lavandulae*, and measures taken to control it.

354. EYSTER, W. H., AND BURPEE, D.

635.937.513 : 575.1

Inheritance of doubleness in the flowers of the nasturtium.

J. Hered., 1936, 27 : 51-60.

A large number of crosses were made between various single-flowered varieties of nasturtium, *Tropaeolum majus*, and the double-flowered fragrant type known as Golden Gleam. The F₁ plants with few exceptions produced single flowers, indicating dominance of singleness over doubleness. The few double flowers from F₁ plants showed the flower colour of the Golden

Gleam female parent, and are considered to have arisen through chance selfing. The F_1 plants were grown in fields in California, Argentina, Australia and Porto Rico, where they were allowed to be self-fertilized and intercrossed by natural agencies, and also in greenhouses and experimental gardens in Pennsylvania, where they were self-fertilized by hand. The F_2 progenies from these plants segregated into single and double-flowered plants in the approximate ratio of 3 : 1, and produced a wide range of colours. Fragrance like doubleness was found to be a recessive Mendelian character. The number of genes involved in the differentiation of colours has not yet been definitely determined. In addition to these new, double, fragrant varieties, a plant was found bearing large super-double flowers resembling a carnation when fully expanded. The carpels of the super-double flowers are completely sterile, and it is thus impossible to obtain plants which are homozygous for this character. Crosses between heterozygous super-double flowers and ordinary double flowers yielded approximately equal numbers of super-double and ordinary double F_1 plants. A similar result was obtained from crosses between super-double and single flowers, and it is therefore considered that this extreme doubleness is inherited as a dominant characteristic over both singleness and ordinary doubleness. This super-double nasturtium, which also shows unusual vegetative vigour, has been granted a U.S. plant patent.

355. PYE, A. C.

635.944

The modern dahlia.*J.N.Z. Inst. Hort.*, 1936, 5: 43-51.

A brief historical account is given of the dahlia from the time (1651) when it was first noted in Mexico. Subsequent introductions to Europe and the evolution of modern types are outlined. Mention is made of various features upon which breeders of new varieties might with advantage concentrate, and finally notes are provided on the principal groups of dahlias at present cultivated.

356. BAMFORD, R.

635.944 : 575.17

The chromosome number in *Gladiolus*.*J. agric. Res.*, 1935, 51: 945-50, bibl. 14.

The basic chromosome number of the genus *Gladiolus* is 15. Diploid, triploid, tetraploid, pentaploid, hexaploid, octoploid, and hyperenneaploid species and hybrids have been found. The majority of species are diploid and all of the summer-flowering commercial varieties which were studied are tetraploid. The subsection *Dracocephali* and the European-Asiatic group contain most of the polyploids. A brief discussion of the possible origin of the tetraploids, in view of their parentage, is presented. The chromosomes are small and of approximately the same size. [Author's summary.]

357. BEAUMONT, A., AND OTHERS.

635.944 : 632.42

Tulip fire.*Ann. appl. Biol.*, 1936, 23: 57-88, bibl. 49.

The symptoms of fire, the life history of the fungus causing the disease, *Botrytis Tulipae* (Lib.), and its economic importance are described and discussed. Observations and experiments dealing with control measures are given. Fire is considered to be an excellent example of a disease that can be brought under control by strict attention to hygienic details. Of these the roguing and destruction of primary infections, i.e. fire lesions, is of paramount importance. If, in addition, the bulbs are handled with care to avoid mechanical damage, are lifted each year, cleaned, and replanted in fresh soil, successful control will be attained. Experiments have been made with spraying and dusting, and with bulb disinfectants, but the results have so far shown little promise, one of the difficulties being the susceptibility of tulips to spray and dust injury. In any case such operations should be regarded as subsidiary to hygienic measures. Trials on different depths of planting, from 4" to 12", suggest that the amount of primary infection may be reduced by deep planting, but as the percentage of bulb rot may increase, and the method involves additional time and labour, the advantages are doubtful. Planting in rows rather than in beds to give wide spacing has been observed to have beneficial effects on reducing

fire. No relation has been noted between epidemics and soil acidity and lime content, and an experiment with the manuring of tulips grown in soil which had not previously supported this crop suggests that dung may safely be applied in preparation for tulips. Shelters designed to break the force of wind, but not eliminate it and so encourage high relative humidity, may reduce fire

358. STANILAND, L. N. 635.944-2.7
Hot water treatment of narcissus bulbs.
12th Annu. Rep. Seale-Hayne agric. Coll., Dep. Pl. Path., for 1935, 1936,
pp. 12-5, being *Pamphl. 46.*

In previous experiments* it was found that the hot water treatment of narcissus bulbs to control eelworm could be varied as to length of time according to the size of the bulbs. At the standard temperature of 110°F. the smallest bulbs required only 45 minutes, and few bulbs were large enough to need more than 2½ hours, whereas the standard time is 3 hours. When, however, these findings were translated into practice on a larger scale, incomplete control of eelworm resulted. Several possible explanations were put forward, and have since been investigated. Of these the efficiency of the baths used alone supplies a satisfactory answer. The bath used in the original experiment was small and efficiently heated. In subsequent trials larger baths were employed, and it was found that large variations in temperature existed in different parts of these baths. As a result of an examination of 24 baths the following recommendations are made: (1) In baths holding more than about 28 lb. bulbs some form of stirring or circulation of the water is necessary. (2) The thermometer should be placed close to the bulbs. (3) Square wire mesh containers should be used in place of sacks to hold the bulbs, as the latter prevent proper circulation. (4) Round baths are better than square, allowing freer circulation and avoiding cold corners. (5) In large baths the correct steam pressure is 5-8 lb. Too high pressure leads to overheating which may not be indicated by the thermometer. Where definite eelworm infection is known to be present, it is recommended that commercial formalin (40% formaldehyde) be added to the bath at a rate of 1 quart per 100 gallons water. Experiments are in progress to test the value of other chemicals for this purpose.

CITRUS AND SUB-TROPICALS.†

359. FROST, H. B. 634.31
Four new citrus varieties—The Kara, Kinnow, and Wilking mandarins and the Trovita orange.
Bull. Calif. agric. Exp. Sta., 597, 1935, pp. 14, bibl. in text.

Problems associated with the limitation of citrus varieties for commercial purposes and with the breeding and introduction of new varieties are discussed briefly. The three new mandarins and the new orange, which are here described in detail, are being introduced for preliminary trials only, and the stage has not yet been reached at which they can be recommended for commercial planting. The Kara is an F₁ hybrid of satsuma, probably Owari, pollinated by King mandarin, and Kinnow and Wilking F₁ hybrids of King pollinated by Willow Leaf (China) mandarin. The Trovita orange is a chance, non-navel seedling, probably originating from a bud variation in Washington Navel. The three mandarins possess new and excellent flavours, good size, and a long season. They are especially good as juice fruits. The orange may prove a useful substitute for the Washington Navel in some of the hotter citrus areas.

360. MARLOTH, R. H. 634.3 : 545.81
Notes on colorimetric tests for citrus species.
J. Pomol., 1936, 14 : 1-8, bibl. 5.

The methods of Halma and Haas (*Plant Physiol.*, 1929, 4 : 265-8) used in their colorimetric tests for the identification of citrus rootstocks in U.S.A. are being investigated to discover their

* *J. Minist. Agric. Lond.*, 1933, 40 : 342-55, *H.A.*, 1934, 4 : 1 : 98.

† See also 278, 280.

suitability for South Africa conditions. The tests used were the *modified almen* (*J. Pomol.*, 1934, 12: 99-104), the ammonium molybdate, the titanous chloride and the ferric chloride tests. The materials tested consisted of aqueous extracts of roots and leaves—oven or air dried (which is immaterial) and ground bark. Fresh lemon bark was scraped to give (a) the outside layers down to almost the last of the chlorophyll, (b) the rest of the chlorophyll-containing tissue and most of the old phloem, (c) remaining layers giving no chlorophyll but all the young phloem. Portion (a) gave dense reactions, (b) gave the colour characteristic for lemon, (c) no colour reaction. The depth of colour obtained in a reaction depended greatly on the thickness of the fresh cut bark sample and also on the age of the tree. It is essential, if differentiations are to be made between a large number of citrus varieties, that samples should all be mature and of approximately the same age. The most suitable bark thickness is from 1.5 mm. to 3 mm. Leaves and roots do not give consistent reactions. The methods of using the four reagents are described and a table is given showing the colour reactions with each of 15 varieties of citrus. The colour reactions given by hybrids showed no correlation with the reactions obtained with the known parents. The author concludes with the opinion that these identification methods will never become of more than restricted value until the actual source and cause of the colour reactions is known and the reacting constituents in the bark can be determined quantitatively.

361. HOWARD, R. H.

634.3

Citrus production costs and returns for four years.*Citrus Ind.*, 1936, 17: 4: 6-7.

The main part of the article is an examination of the local costs of production in Florida. Over a four-year period the average return for orchards averaging 18.5 acres was 4.6 per cent. on the appraised valuation and owner's supervision. Costs include local taxation. Points of general interest emerge. In the study of relationship of age to costs over 26,401 acres it was clear that costs and returns increased as the groves grew older, but that the net returns increased proportionately faster than the costs on a per acre basis. The average cost per box decreased as the groves grew older. The age for maximum grove costs and returns could not be decided owing to an insufficient number of groves over 20 years old, but the greatest proportion of increase in returns per acre and per box occurred on groves over 20 years old. Returns from half a million grapefruit trees showed an increase of .3 box per tree and for one million orange trees an increase of .15 box per tree per year up to 20 years.

362. OPPENHEIMER, H. R.

634.31-1.541.11

A citrus rootstock trial on light soil.*Hadar*, 1936, 9: 35-40, bibl. 4.

The following nine species and varieties of *Citrus* are being tested in Palestine as rootstocks for the Shamouti (Jaffa) orange on poor, light soil: Sweet lime, *C. aurantifolia* var. *dulcis*; sour lemon and rough lemon, both *C. Limoni*; citron, *C. medica*; "Baladi" and "Shamouti"; both local sweet oranges, *C. sinensis*; sour orange, *C. Aurantium*; pummelo, *C. maxima*; and grapefruit, *C. paradisi*. All the stocks were seedlings, and, with the exception of sweet lime, sour lemon and rough lemon, were 3½ years old when planted. In the present progress report, root, girth and height measurements are given for the two years which elapsed between planting in 1933 and budding in the autumn of 1935. The irrigation and cultural treatments are described. The rough and sour lemons, citron and sweet lime made very vigorous growth, the sweet oranges and pummelo intermediate, and the sour orange and grapefruit very poor growth. The effect of pruning the trees to a three-branch system in the early summer of 1935 in preparation for budding was found to be markedly dwarfing in comparison with unpruned trees. It is, therefore, considered desirable to find methods of preparation for budding which do not involve severe pruning.

363. WRIGHT, N.

634.323 : 581.145.2

On the seedlessness of citrus fruits with particular reference to Marsh grapefruit.*Trop. Agriculture, Trin.*, 1936, 13 : 118-22, bibl. 12.

The causes of and possible remedies for a high percentage of seediness in orchards planted with supposedly seedless citrus trees is discussed. The mechanism of fruit development in citrus, which differs somewhat from that in most other trees, is described. The possible causes of fluctuation in the normal seed content, i.e. increased seediness in seedless types, may be due (1) to cross pollination with nearby, compatible, pollen bearing varieties, or (2) to bud mutation, while the possible effect of environment should not be overlooked. A number of authorities are quoted in support of these statements. The remedy consists in the case of (1) in removing nearby trees which are likely to be the source of fertile pollen, even though the pollen bearing tree may be itself self-sterile and seedless. Suggestions are made for tracing these trees. It should not be forgotten that seedless trees may throw a mutated branch bearing fertile pollen which would be quite enough to induce seediness in surrounding trees. In (2) the mutant or rogue tree must be either replaced or topworked, as is most convenient, or individual mutant branches can be removed. It is emphasized that the opinions put forward form by no means the last word and that further investigations are needed, particularly as regards the local aspects of the problem (Trinidad). The direction these investigations should take must await results of the preliminary survey which is about to take place. The suggested lines of approach for this survey are:—(1) Seed counts from trees in localities differing in rainfall, soil, aspect, manuring, age, time of flowering and proximity to other trees. In this connexion methods of sampling are discussed. (2) Artificial pollinations to discover which trees are fertile to Marsh grapefruit and their effect on seed number.

364. TRAUB, H. P.

634.3 : 581.163

Artificial control of nucellar embryony in citrus.*Science*, 1936, 83 : 165-6, bibl. 3.

The effect of reducing the food supply available to the pericarp on the initiation of development of nucellar embryos was studied in several citrus species by covering the pericarp and the surrounding leaves with three thicknesses of cheesecloth up to maturity. The seeds from these "starved" fruits were subsequently germinated in flats. The number of seeds producing more than one embryo were found to be from 51%-100% below expectancy. Segregation for leaf characters occurred in the progeny from "starved", self-pollinated grapefruit and sour orange fruits, indicating that in most cases they are of seminal origin. In the first case sweet orange types, grapefruit types and intermediates were in evidence, and in the second case sour orange, intermediates and sweet orange types were found. This tends to confirm the common belief that the grapefruit and sour orange are naturally occurring hybrids with the sweet orange. This preliminary work is being supplemented on an extensive scale.

365. DALLAS, W. K.

634.334-1.56

Lemon curing for small growers.*N.Z.J. Agric.*, 1936, 52 : 103-5.

The fruit should be carefully clipped from the trees when it has reached 2½ in. to 2½ in. in diameter, and is still green or silver-green. Lemons ripened on the tree are less lasting. Allow the fruit to wilt for 4 days in an airy shaded situation, then immerse for 4 minutes in a solution of 4 lb. borax to 5 gallons of water heated to 110°F. When dry place the fruit in a close-sided box or one lined with paper or in trays and covered with canvas, or between successive layers of slightly damp sand or sawdust. Temperature should be maintained between 45° and 65°F. with a relative humidity of approximately 75%. The store room should be dark and well ventilated and free from draughts. The curing process will take from 6 to 10 weeks, the green lemons taking longer than the silver green. Properly cured lemons should have a smooth, soft, yellow rind and keep for several months.

366. BAUMGART, S. 634.3-2.19
Xyloporosis, the new disease, its causes and prevention.
Hadar, 1936, 9: 71-4.

The "new disease", or xyloporosis, attacks budded lime stocks and is considered to be of physiological origin. Internal symptoms are cessation of growth of cambium and therefore of the annual rings at the affected spots and the development of a lesion affecting cambium, phloem and xylem, occurring largely at junction of stock and scion. External symptoms are in the form of pores in the wood and corresponding pegs in the bark. It has been well described by Reichert and Perlberger (*Hadar*, 1934, 7: 163-7, 193-202; *H.A.*, 4: 4: 616). The phenomenon is thought to be caused by the stoppage of descending sap at the point of insertion of the bud and full reasons in support of this theory are given by the author. The disease is most frequent on trees on which the budding has been unskilfully done, and on trees which have been otherwise injured. The disease may be largely prevented by using the T instead of the inverted J incision when budding, thus preventing wounds below the budding eye which would be likely to hinder the flow of assimilated food elements. Among other possible factors which may occasion the disease and require investigation are the penetration of poisonous materials into the tissue at budding, the pressure exerted by the edges of the cut bark on the swelling bud between them, and trunk wounds during the removal of stubs.

367. EBELING, W. 634.334-2.752
Progress report on the interval method of applying oil sprays for the control of the California red scale on lemons.
 Reprinted from *J. econ. Ent.*, 1935, 28: 965-71, bibl. 3, being *Pap. Univ. Calif. Citrus Exp. Sta.*, 331.

It has been shown that all stages of the California red scale, *Aonidiella aurantii* (Mask.), below the mature adult are comparatively easily killed by oil sprays. The principle of the interval method of spraying is to use oil concentrations far below those normally used to kill the adult stage, but to repeat the applications two or three times during the summer and so destroy successive generations of young scales with greater economy and less injury to the trees. The factors upon which the method depends for its effectiveness are outlined. It is particularly adapted to lemon trees and results are given of five preliminary experiments conducted in lemon groves. In general these results indicate that the interval method deserves an extensive trial in comparison with present oil spray methods. Commercial tests on a large scale have also shown the inadvisability of using light oils in the interval method. This appears to be because light oils not only deposit less oil, but the absorption of the oil by the bark of the trees is much more rapid than with heavier oils. The author considers that nothing lighter than a Grade 4 oil will prove satisfactory. Further experiments have been planned.

368. JOHNSON, P. R., AND YARNELL, S. H. 633.85
The tung-oil tree in Texas.
Circ. Tex. agric. Exp. Sta., 75, 1935, pp. 16, bibl. 8.

There are two regions in Texas where the planting of tung trees may be recommended, and this circular sets out the information obtained from experimental trials established in Texas and from experience gained elsewhere in the U.S. Soils should preferably be light, neutral to slightly acid, reasonably fertile, and well drained. In areas subject to summer droughts a high water-holding capacity of the soil is desirable for establishing the trees. Low temperature injury is an important consideration, and sites should be chosen to provide adequate air drainage. Tung trees will withstand moderate frosts when dormant, and possess unusual regenerative ability when branches are killed back, so that apart from complete killing by severe frosts, injury by cold is chiefly of importance because the crop may be lost thereby. Propagation is mainly by seed, though some budding has been done in Florida. Germination takes 3 weeks to 3 months and may be hastened by careful cracking of the hull or seed coat. Considerable

variation has been found in the seedlings as regards yield, oil percentages, tree size, fruiting habit and resistance to cold. Figures are tabulated to show differences found between several selected strains. A comparison between cultivated trees and trees grown in sod has shown that clean cultivation, especially during the first few years, is desirable for early growth and cropping. Fertilizer requirements are still in the experimental stage. Pruning may be necessary to encourage a low branching habit, but thereafter only interfering branches and dead wood should be removed. Various diseases and pests may appear, the worst of which is a nematode. Short notes are added on harvesting, yields and co-operative trial plantings.

369. FERRA, G. J. A. 634.451
De stand van de cultuur van kesemek in het Regentschap Garvet. (*Diospyros*
Kaki in Garut, Java.) [English summary.]
Landbouw, 1936, 11: 326-36.

The only centre of kaki (*Diospyros Kaki* L.f.) culture in Java is in the Regency of Garut, 1,000 m. above sea level. About 40,000 trees are grown, all, so far as is known, the vegetative descendants of a single seedless fruited plant brought from China about 50 years ago. Propagation is by root suckers. The plants are interplanted with tea and are given no cultural attention. The mean annual crop is 220 fruits per tree which never ripen fully. The usual time for picking is when the fruits are still hard and green. The astringency is removed by soaking in lime water. Japanese varieties on *D. Lotus* have been introduced but have failed to grow, so that budwood of these varieties for use on the local *D. Kaki* stock is scarce. There was also some difficulty in transplanting the young *D. Kaki* stocks until it was discovered that plants over a year old could be transplanted successfully when dormant. They could be budded a year later, just as growth begins, by the modified Forkert method.

370. ANON. 588.427
The culture of granadillas (*Passiflora edulis*).
E. Afr. agric. J., 1936, 1: 384-6, 383.

Seed, if selected, should be taken from fully matured fruit having a high percentage of juice combined with total weight. It is best extracted by fermenting the pulp in water long enough for the seed to become separated, subsequently washing, straining and drying. Another method is not to wash the seed but to dry it by mixing it with sand. Before sowing it should be soaked overnight in water with an initial temperature of 180°F. Seeds are sown in soil of a light, free nature under shade and planted out when 1 ft. high at 15 to 20 ft. apart and trained along the wires of a stout trellis 5-6 ft. in height. Only two main laterals should be allowed on each plant. These are stopped when they meet on the top wire and the fruit is produced on the secondary laterals and their subsequent shoots. The tangled growth thus produced needs systematic pruning which can be so contrived as to bring in the crop at different times of the year. An autumn or winter crop is obtained by pruning the vines back to the secondary laterals when they are coming into blossom for the summer crop. Severe pruning should not be done in dry weather. Heavy manuring is advised. Yield figures for Kenya are not available but those quoted (with caution) from unofficial sources in New Zealand show for established plantations a juice production of 340-420 gallons per acre, the price in London being about 5/- per gallon. Methods of juice extraction and preparation are reprinted on p. 421 *et seq.* from *Fruit Products Journal*, New York, 1935, 14: 9: 264, *H.A.*, 5: 2: 316.

371. POPE, W. T. 588.427
The edible passion fruit in Hawaii.
Bull. Hawaii agric. Exp. Sta., 74, 1935, pp. 22, bibl. 18.

Experiments with the edible passion fruit have been in progress in Hawaii since 1924, and the information obtained from these and other studies elsewhere is summarized in this paper. As regards botanical relationships a number of species of the genus *Passiflora* are concerned. Several of these do not set their fruits regularly even when bees and breezes are present. Hand-pollination has also sometimes failed. Studies have shown that some species tend to produce

protandrous flowers, i.e. the pollen ripens before the stigmas are receptive. A warm, dry atmosphere, however, encourages early maturity of the stigmas, and it is suggested that for such varieties special attention should be paid to the locality and to the arrangement of the rows and trellising so as to provide maximum exposure to the sun. The chemical composition of fresh passion fruit (*P. edulis*) has been determined, and the analysis of rind, seeds, and juice are tabulated. The extraction and local sale of juice has also been the subject of investigation. Among general cultural requirements the selection of site must depend upon the species or variety to be grown and its pollination habits. Some types will fruit freely up to an altitude of 3,000 ft. None of the species grown appears to be particular as to soil, although badly drained or sour soils are unsuitable. The plants show considerable drought resistance, but irrigation may be necessary in some areas to achieve good results. Propagation is commonly from seed, though cuttings may be used. The former method is described. Notes are also supplied on soil preparation, trellises and planting, tillage, fertilizers, pruning, harvesting and marketing. The only pest of local importance is the Mediterranean fruit fly, and no fungus diseases have so far been reported. Finally descriptions are given of the following six species: The purple passion fruit, *P. edulis*; the yellow passion fruit, *P. edulis flavicarpa*; the sweet granadilla or watermelon, *P. ligularis*; the giant granadilla, *P. quadrangularis*; the bell-apple, *P. laurifolia*; and the sweet calabash, *P. maliformis*.

TROPICAL CROPS.

372. LAMBOURNE, J.

631.534 : 635.952.2

The etiolation shoot method of fruit propagation.

Malay. agric. J., 1935, 23 : 514-27.

The "etiolated shoot" or "etiolation" method of propagation is described in an earlier paper.* The experiments were started in July 1932 at Serdang and have been continued there and at other stations throughout Malaya. The present paper records the results obtained with a large number of fruit trees up to September 1935. These are as follows: Avocado pear, *Persea gratissima*; brazil nut, *Bertholletia excelsa*; carambola, *Averrhoa Carambola*; chiku, *Achras Zapota*; citron, *Citrus medica*; coco plum, *Chrysobalanus Icaco*; duku, *Lansium domesticum* var. *duku*; durian, *Durio Zibethinus*; grapefruit, *Citrus decumana*; guava, *Psidium Guajava*; jack fruit, *Artocarpus integrifolia*; jambu ayer mawar, *Eugenia aquea*; jambu chilly or jambu betai, *E. javanica*; jambu kelampok (rose apple), *E. Jambos*; kerandang, *Carissa Carandas*; lemon variety Villa Grande, *Citrus Limonia*; lime, lemon shaped and a large fruited variety, *C. aurantifolia*; mango (Indian), *Mangifera indica*; wild mangosteen, *Garcinia Hombroniana*; Washington Navel orange, *Citrus Aurantium*; mandarin orange, *C. nobilis*; pomelo, *C. maxima*; pulasan, *Nephelium mutabile*; rambutan, *N. lappaceum*; soursop, *Annona muricata*; tamarind, *Tamarindus indica*. Other crops under trial are coffee, gambier, tea, and cinnamon. In summarizing the results to date the author notes that it has been found possible to propagate a large number of these plants by the etiolation method. Some root freely and give rise to large quantities of plants from small beds. In other cases rooting may occur, but too slowly to make the method appear more satisfactory than marcottage or budding. Further investigation is, however, necessary before definite assertions can be made. In general shading and watering and/or mulching the etiolation beds during dry weather has proved beneficial to both root and shoot production. Periodical manuring has also been found necessary, and after a crop of shoots has been removed cattle manure and an artificial mixture consisting of calcium cyanamide, 1 part by weight, basic slag 2 parts, and sulphate of potash 1 part are worked into the beds. The establishment of plants after they have rooted has often proved difficult, and methods of reducing casualties are to be further investigated. Trials are also to be started of the stool method as used at East Malling for the propagation of apple stocks.

* Malay. agric. J., 1934, 22 : 58-62, H.A., 1934, 4 : 2 : 279.

373. ALDAMA, M. J. 631.535.4
Studies under field conditions of propagation by stem cuttings of three species of derris.

Philipp. Agric., 1936, 24: 776-94, bibl.

Cuttings of *Derris elliptica* (Roxb.) Benth, *D. polyantha* Perk. and *D. philippensis* Merr. were planted monthly under field conditions. The cuttings were of six sizes, namely 15 cm. long and 1, 2 and 3 cm. in diameter and 30 cm. long and 1, 2 and 3 cm. in diameter. The relative percentage of sprouting at the end of four weeks was low in the hot months from February to May, after which it increased to a peak in September with a decrease in October to December. With *D. elliptica* the mean percentage of sprouting ranged from 10.45 ± 1.21 to 31.45 ± 5.71 , but with the other two varieties it never rose above 10.09 ± 2.58 , and all types of cuttings gave low results. With *D. elliptica* cuttings 15 cm. long and 3 cm. in diameter gave the highest mean percentages of sprouting.

374. TAMBE, G. C., AND WAD, Y. D. 633.61-1.87
Humus manufacture from cane trash.

Bull. Inst. Plant. Ind., Indore, 3 of 1935, bibl. 18, reprinted from *Int. Sug. J.*, 1935, 37: 260-3.

It was found that sugar cane trash did not break down easily under any of the usual variations of the process of composting known as the Indore process. (*Waste products of agriculture*, A. Howard and Y. D. Wad, 1931. Oxford Univ. Press.) Rapid decomposition was finally achieved by building the compost heaps of alternate layers, 4 inches thick of cane trash, and $1\frac{1}{2}$ inches thick of green vegetation collected in the vicinity. After a few days, by which time the green vegetation had decomposed, the heaps were broken open and remade in a similar manner. This was repeated a total of 5 times. The compost was ready in 5 months including a month's weathering. Later trials showed that the subsequent additions of green growth were superfluous and an initial "sandwiching" would have been enough, but that the subsequent turning of the mixture must not be delayed (roughly one turn every 3 or 4 weeks). A table shows the analysis of cane trash compost compared with other composts and farmyard manure.

375. COSTE, R. 633.73
Notes et observations sur la culture du caféier arabica au Cameroun. (Arabica coffee in the Cameroons.)

Agron. colon., 1936, 25: 72-7, 103-17.

The successful attempts since 1929 to establish arabica coffee in place of the less valuable robusta in certain districts in the Cameroons are described. At the present time 3,000 hectares of arabica are under cultivation, of which 600 are under native ownership. Seeds are sown under shade from selected high yielding plants and are pricked out and left unshaded after they have made 3 pairs of leaves. When a cool soil is available, great success has attended the method of pricking out the seedlings at a very early stage before the cotyledons have fully expanded. The plants are finally set out in the unshaded field when from 15-18 months old. The practice of planting at 7 or 8 months has been abandoned owing to the losses incurred. If, however, a planting instrument called the "Java" (not described) is used, such plants can be lifted with a ball of soil attached and failures are then few. An important point in field planting is to see that the tap root is perpendicular. Cases are instanced in which large numbers of trees planted hurriedly have died at 5 or 6 years as a result of a bent tap root, the immediate cause being exhaustion following cropping. In this district it is possible to use oxen for drawing the cultivating implements, chiefly a disc harrow and a hoe. The pruning method, which is described, is the single stem system, based on that in use in Kenya. Pests and diseases are at present few, but the appearance of *Hemileia* in one or two plantations is causing some apprehension. Yields and markets are discussed and the case for the establishment of a coffee research station in the locality is put forward.

376. TRENCH, A. D.

633.73

Notes on conditions influencing quality in coffee.*E. Afr. agric. J.*, 1936, 1: 281-2.

The conditions which favour the production of coffee of good appearance and good liquoring properties in Kenya are:—adequate rainfall, which is of primary importance as it has a great influence on the colour and development of the bean; an even climate with a mean minimum of 50°F. and a mean maximum of 80°F., which in Kenya is attained at an altitude of 5,500-6,000 ft.; a deep top soil well supplied with humus; and a well-drained heavy subsoil. In addition to these natural conditions, good cultivation, including the maintenance of soil fertility and the prevention of overbearing are essential. Out of season crops, which have been recently produced by irregular and inadequate rainfall aided by out of season pruning, seldom produce good coffee. The effects of drought can be minimized by mulching and by box ridging, which is a method of preventing soil erosion applicable to moisture conservation. Out of season or drastic pruning should be avoided.

377. RIPPERTON, J. C., AND OTHERS.

633.73

Coffee cultural practices in the Kona district of Hawaii.*Bull. Hawaii agric. Exp. Sta.*, 75, 1935, pp. 64.

The bulletin presents the tentative results of the Hawaii Experiment Station's investigations into arabica coffee growing in the Kona district of Hawaii. This district is situated on the leeward slopes of two volcanoes and provides several zones which differ climatically. The coffee is mainly grown at an altitude of 1,000-2,000 ft. in a mild, wind-free climate which provides a moist period of about 6 months during blossoming and maturing of crop, a decrease of rainfall during the subsequent 3 months and 3 months of dry weather during harvesting. At the lower edge of the plantings there is excess of sunshine with a minimum of moisture, at the upper edge the reverse is the case. These differences are combated by a variety of pruning systems which are thoroughly described and illustrated. The pruning systems of other countries are also noticed. High grade commercial fertilizers are applied often at as high a rate as 3,000 lb. per acre and 1,500 lb. on the better tilled areas. This is in sharp distinction to other countries where, it is stated, fertilizers for coffee are applied with a niggardly hand, if at all. In Kona, however, fertilizers are very cheaply and readily available, with the result that an intensive culture has grown up which has been justified hitherto in the eyes of the farmers by high yields and profitable returns. Withholding the fertilizer for two years causes a sharp and permanent drop to one-third or one-fourth of the former yields. The method of application is to rake out the fallen leaves and debris from under the tree and to apply the fertilizer in a narrow band just below the drip of the tree, covering it with the raked out trash and a little soil. No attempt is made to dig it into the soil. This results in an excessive development of surface roots, making the plant susceptible to droughts, which, however, seldom occur. Animal manure is practically unobtainable, but, in a case where a grower used a mulch of grass and weeds laid down a foot thick and turned them monthly, the yield increased in four years by 5 bags of parchment coffee per acre. It is pointed out that the manurial value of coffee pulp is considerable and that the pulp should always be returned to the soil. Propagation is either by collected seed or by adventitious seedlings which have germinated among stones and can be taken up with the root system intact simply by removing the stones. The usual size for removal is from 3-8 inches. The bulletin describes fully the methods of cultivation used in this district, many of them somewhat unorthodox, and compares them with the methods prevailing in other countries.

378. NOTLEY, F. B.

633.73-2.73

Coffee thrips.*E. Afr. agric. J.*, 1936, 1: 283-92.

This article is an attempt to explain on climatic grounds the incidence of thrips (*Diarthrothrips coffeae* Williams) on coffee during 1932-5 in the Central Province of Kenya, and its incidence

during an outbreak on different parts of infested plantations. The conclusions, for which finality is not claimed, are as follows:—The correlation of thrips epidemics with drought is questioned. An average mean monthly temperature of 65°F. for 4 successive months coincided with a mild infestation. In 1934-5, when for 6 successive months the average mean was higher, there was severe infestation which disappeared when the temperature dropped. There was no direct correlation between thrips incidence and atmospheric humidity or rainfall. Local severe infestations of thrips can be explained by reference to temperature, e.g. on leeward slopes or the leeward side of windbreaks where the temperature is higher, or on poor dry soil where the plant's restricted transpiration is less effective in lowering the temperature of the leaf surface. It is claimed that the fact of this correlation of thrips with high temperature should make it possible to foretell the chances of a severe thrips infestation a month or two in advance and so prevent it by early spraying. For instance from January-April the temperature is high enough to encourage thrips, but the heat of these months alone is not enough to encourage a severe epidemic. The determining temperatures apparently occur in November and December and, if these months exceed the normal, an outbreak may be expected and spraying should begin in January. The insecticide recommended is lime-sulphur at a concentration which gives a density of 1° Baumé (specific gravity, 1.007).

379. WALLACE, G. B.

633.74-2.4

A root disease of cacao.*E. Afr. agric. J.*, 1936, 1: 266-8, bibl. 11.

A root rot disease of cacao and kapok growing together on a plantation in the Usambara Mountains has been found associated with the fungus *Ustulina zonata*. The symptoms of the disease agree with root rot diseases in general in that the leaves droop, turn yellow and brown, finally fall and are not replaced by new foliage. No rhizomorphs or cracking of the roots are shown as in *Armillaria* root rot nor is there the characteristic mushroom odour of *Armillaria*. Both diseases have in fact been found on the same tree. *Ustulina* effects, however, resemble those of *Armillaria* in their dry action and in the production of black lines in the wood and also in sometimes parasitizing roots on one side of a tree first. *Ustulina* mycelium forms uniform, often pure white, layers under the bark and into bark tissue. Its feathery nature is characteristic. Fructifications are diagnostic, occurring on the bark of the collar and on exposed roots first as round discs several inches in diameter and $\frac{1}{8}$ inch thick, following the irregularities of the substratum and often uneven in outline. White conidial spores are produced in the early stages. The colour later changes to dull grey, in which the sunken mouths of the perithecia containing the ascospores appear as dark dots. The fructifications turn hard and black and persist as a brittle crust for some time. The difference of opinion among writers as to whether *Ustulina* is a primary or secondary parasite is discussed. The disease is said to have only once before been recorded on cacao. Control measures consist in completely removing infected trees, including as much of the roots as possible, since the disease is spread by inter-tree contact of diseased roots. Groups of infected trees can be isolated by means of a trench and should be removed without delay.

380. SCHUCK, T. G.

633.74-1.536

Comparative study of different methods of transplanting seedlings of *Theobroma Cacao* Linn.*Philipp. Agric.*, 1935, 24: 59-75, bibl. 7.

Of six different methods of transplanting 15 months old cacao plants from the seed bed to the field, the most successful (30.7% and 73.5% on 2 plots) and the cheapest was that in which the plant was cut back to 30 cm. and dug with bare roots. Other methods tried were with balled and with unballed roots, and both combined with full foliage and with each leaf trimmed to one-half.

381. ALICBUSAN, L. A. 633.74-2.4
Beneficial effects on diseased cacao trees of removing infected parts and disinfecting the wounds.
Philipp. Agric., 1935, 23 : 891-904, bibl. 10.

A study was undertaken to determine the causes of the death of branches, twigs, pods and seedlings of cacao, and secondly to discover the effects of removing diseased parts and disinfecting or dressing the wounds. Several species of fungi were isolated from diseased tissue and the pathogenicity of these was tested by inoculations. It was found that black rot of pods, canker of twigs and branches, and blight of seedlings were all caused by the fungus *Phytophthora palmivora* Butl. (syn. *P. Faberi* Maubl.). Species of *Diplodia*, *Fusarium*, and *Gloeosporium* isolated from pods were found to be merely saprophytic on diseased tissues. Infection by *P. palmivora* occurs only through wounds on twigs and branches, but may appear on pods and seedlings where no injury is present. In the experiments 66 trees were divided into 6 lots of 11 trees each, diseased pods were removed and diseased shoots pruned back, and the wounds were dressed with six different materials. There were 12 check trees, 6 of which were pruned but not painted, and 6 were not treated in any way. Trees pruned and treated with bordeaux paste or white lead paint appeared to be the most vigorous, and produced the largest number of pods. There was little apparent difference between trees pruned and treated with coal tar, 5% formalin solution, 5% copper sulphate solution, and sapolin paint, and the check trees pruned without painting, although the latter produced more new leaves and twigs. The entirely untreated trees produced the least number of pods. It is emphasized, however, that these results were judged solely on appearance, that the trees used were not uniform in age, vigour or spacing, and that soil conditions varied.

382. CHEVALIER, A. 633.88.51
 Cinchonas cultivés dans les contrées tropicales et subtropicales de faible altitude. (*Cinchonas cultivated at low altitudes in warm countries.*)
Rev. Bot. appl., 1936, 16 : 276-8.

Quinine, to be a commercial success, must be produced from high yielding trees requiring special environmental conditions. Of the 40 or so different species of *Cinchona* all have been discarded as commercial sources of the drug, which is now practically entirely produced from hybrid trees grafted on *C. robusta*. Possible milieus for quinine cultivation in the French colonies are then discussed. Most of the experimental trees in the African colonies have died out, but Indo-China has a climate which is well suited for the cultivation of the modern high yielding *Cinchona*.

383. BERTRAND, H. W. R. 633.912-1.543.1
Rubber and high shade.
Trop. Agriculturist, 1936, 86 : 139-44.

Hevea is a deciduous forest tree, but does not grow naturally in close stands. It is in its wild state sparingly scattered among the trees of an evergreen forest. Here even in the longest droughts an almost unbroken evergreen canopy is maintained which the author considers to be an ideal condition for the production, maintenance and function of the living soil. When the rubber is grown in close stands there is a gradual impoverishment of the soil which leguminous ground covers such as *Vigna* or *Pueraria* or natural bushy undergrowth cannot successfully combat. The author suggests the gradual establishment of high shade trees in the place of low yielding trees, and suggests that *Albizzia moluccana* is the most suitable one. Among other instances in support of this he cites a case in South India in which all the rubber had been reduced to a "shocking condition" by repeated attacks of *Phytophthora Meadii* except that under *Albizzia* which was perfectly healthy. He attributes this immunity to the extra nitrogen and better soil conditions produced by the presence of the *albizzias*, to their wind-break effect which arrested the carriage of spores, and to the control of the method of attack of the fungus. The *Phytophthora* spores can only attack the undersides of the leaves and they can only develop in water. In the calm atmosphere under *albizzias* the leaves are not blown up nor are their undersides wetted except by natural exudations.

384. PARSONS, T. A.

634.1/8

Fruit cultivation and production.*Trop. Agriculturist*, 1936, 86 : 77-99.

An account is given of certain fruits commonly grown in Ceylon which, it is considered, might prove a commercial success, if cultivation could be developed there on commercial lines. General notes on cultivation are given and usually an account of the progress made in other countries with the particular fruit under discussion. Possible markets are discussed, but the author is of the opinion that the home market provides the best opportunities, since fruit consumption is lower in Ceylon than in almost any other country, and he considers that a good local demand could easily be stimulated. It is merely the high price of imported fruit and the shortage and inferior quality of local fruit which keeps the consumption low.

385. STEPHENS, S. E.

634.34

Some tropical fruits. 5. The wampee.*Qd. agric. J.*, 1935, 45 : 178-80.

The wampee, *Clausena lansium*, *C. Wampui*, or *Cookia punctata*, is a rutaceous tree, probably native of S.E. China. It is occasionally found in gardens in Queensland. The tree and its fruit are described. The fruit is eaten fresh or may be made into jam or jelly. Propagation is usually by seeds which germinate in a few days, but experiments in the Philippines have shown that shield-budding may also be used successfully. The tree requires tropical conditions, and a rich, well-drained soil with plenty of moisture gives the best results.

386. STEPHENS, S. E.

634.39

Some tropical fruits. 6. The jack fruit.*Qd. agric. J.*, 1936, 45 : 67-8.

The jack fruit, *Artocarpus integrifolia* or *A. integra*, is a native of India and Malaya. A close relative of the bread fruit, it will, however, grow under a much wider range of conditions. It is fairly plentiful in North Queensland. A rich, deep soil with abundant moisture but good drainage is the most suitable. The site should be free from frost. The tree and its very large fruits are described briefly. Propagation is usually from seeds which germinate readily. No experimental work has been done in this connexion, but it is known that several distinct races exist.

387. JULIANO, J. B.

634.41 : 581.4

Morphological contribution on the genus *Anona* Linnaeus.*Philipp. Agric.*, 1935, 24 : 528-41, bibl. 16.

The development of the floral organs and gametophytes of *Anona squamosa* Linn. (present spelling *Annona*—ED.) and *A. muricata* Linn. is carefully worked out. There are numerous clear figures accompanying the paper.

388. ALCALA, P. E., AND SAN PEDRO, A.

634.441-2.111

Bud differentiation in smudged mango.*Philipp. Agric.*, 1935, 24 : 27-40, bibl. 5.

The smudging of mango trees is a practice whereby the trees are kept in a continuous heavy smoke screen for from one to a number of weeks in order to induce early flowering. The reason for the response is uncertain and has been variously ascribed to the effects of the heat produced by the smudging fires and to the "suffocating effect" of the smoke. It is a matter of some importance in view of the labour and expense involved in smudging to determine what diagnostic characters in the early stages will indicate whether floral or foliar structures will arise. If the latter, expense may be saved by discontinuing smudging. In this study a long series of macroscopical and microscopical examinations were made (and are here illustrated) on four mango trees of different varieties, one of which had never fruited, and, it may be said at once, did not now fruit as a result of the smudging. The macroscopic characters differentiating foliar from floral shoots are described in detail and would require a detailed examination

to detect, but a quick diagnosis may be made from the shape of the shoot as growth begins. Foliar shoots present a very marked elongation, whereas floral shoots and mixed floral and foliar shoots generally form a flat cone. The difference between these two types is clearly shown in the illustrations. Microscopically the types of shoot buds can be distinguished from the 6th to the 8th day of smudging. Those which will form flowers exhibit activity in their apical and lateral or axillary meristems, whereas the foliar shoots only show growth confined largely to the apical meristems developing foliage leaves.

389. GREGSON, W.

634.471

The mangosteen in Burma.

Agric. Surv., Burma, 23, 1935, pp. 15.

The mangosteen, stated by A. de Candolle to be a native of the Malay Peninsula, is less readily acclimatized than perhaps any other fruit and its successful cultivation is still confined to certain regions in the Far East, of which Lower Burma is one. A hot moist climate is essential. In the parts of Burma where it is cultivated there are two distinct seasons, a wet period from May to October and a dry period from November to May, the average yearly rainfall being 184 inches. The temperature during the year ranges from 64°F. to 95°F. Deep, organically rich, moist, but well drained soils give the best results, but in drier situations trees have grown well under irrigation during the dry season. A sheltered locality is desirable. Trees in exposed positions do not thrive and a sickly mangosteen never recovers. Cultivation is haphazard. Trees are generally grown in mixed gardens where they do better owing to benefits derived from the manuring and cultivation of ground crops. If grown in pure stands they suffer from lack of attention. Pruning is never done. The length of time (10 years) that a tree takes to come into bearing, discourages planting and it is seldom that newly planted trees are to be found. Trees of 50 years of age, however, are usually still in full health. Plants are raised from seed, sometimes in specially prepared beds, but more often in bamboo pots. In planting out unnecessary disturbance of the root is carefully avoided. Suggestions for improvement in cultivation methods are made. Notes on condition on arrival in England of an experimental consignment are given.

390. LAMBOURNE, J.

634.6 : 581.144.2

Note on the root habit of oil palms.

Malay. agric. J., 1935, 23 : 582-3.

A survey of the root system of 11-year-old oil palms was made at the Central Experiment Station, Serdang. The land was level and the water table in dry weather about 3' below the surface. The surface roots were exposed to a radius of 18' from the stem and it was found that they formed a network over the whole area between palms. Individual roots were traced up to distances of 20' from the stem, and there is evidence to show that they may spread much further. In trenches it was found that the majority of roots were concentrated in the top 18" and that comparatively few roots penetrated below 3', although in well drained soils penetrations to 12-14' have been recorded. Of the roots emerging from the sides of trenches 71% were alive, 19% were decaying in the centre though superficially alive, and 10% were dead. The results indicate that manures should be broadcast in oil palm plantations.

391. SALGADO, M. L. M.

634.61 : 631.83

Studies on the coconut palm. III. Coconut husk. A. The manurial value of coconut husk ash.

Trop. Agriculturist, 1936, 86 : 131-8, bibl. 7.

The paper is the first of a series of studies on the proper utilization of husk for manurial purposes on coconut estates. The studies have been planned by the Soil Chemist's Department of the Coconut Research Scheme. Husks, unless they can be sold to fibre mills, are usually buried between the rows of palms, mulched round trees after manuring in circular trenches during drought, used for filling up drains and low lying portions of land and in the preparation of ash by burning. It is the manurial value and preparation of ash which is discussed here. The ash

was obtained by burning under a slow fire in order to obtain the maximum recovery of potash. High temperatures should be avoided as they cause the loss of potash salts by volatilization and are liable to produce fused, hard, clinker-like masses instead of the fine, dry ash powder which is desired. The ash should be stored in a dry place. The complete analyses of the ash of the husks, samples of which are recorded, show it to be a valuable potash manure containing about 35% potash and 2% phosphoric acid. Husks from trees on loamy soil produce about 15 lb. of potash per 1,000 husks and those from gravelly soils about 10 lb.

392. COOKE, F. C.

634.61

The coconut industry of the Philippine Islands.

Gen. Ser. Dep. Agric. S.S. & F.M.S., 23, 1936, pp. 101, bibl. 38 + bibl. footnotes.

The bulletin is the result of a survey of the industry undertaken by the author in 1934 under instructions from the Federated Malay States Government in pursuance of their policy of examination on the spot of the coconut industries of other countries. It contains a complete account of the industry, including cultivation methods, manufacture in factory, small holding and cottage, marketing and economic conditions.

393. GEORGI, C. D. V., AND LAMBOURNE, J.

634.61-2.69

Note on the use of barium carbonate as a rat poison on oil palm estates.

Malay. agric. J., 1935, 23 : 580-1.

Freshly-opened female inflorescences have, in addition to the fruits, been recently subject to attacks by rats. A suggestion that barium carbonate, which is used in baits for rats, should be sprinkled on to the inflorescences has been tested to determine the effect of the treatment on pollination and to discover whether barium compounds could be introduced in toxic quantity into the oil. A comparison of inflorescence sets when pollinated after treatment and before showed that the application of barium carbonate does not inhibit pollination. In testing for toxicity the maximum possible percentage of barium carbonate in the oil was estimated and this proportion of the poison (1 in 200) was added to a quantity of crude oil. In subsequent processes for purifying the oil it was found that only 1 part barium chloride in 26,000 parts oil remained, and it is very improbable that this concentration could have a deleterious effect on health. In actual practice, therefore, where further reductions would occur through the removal of barium carbonate by wind and rain, there can be no real danger.

394. BLISS, D. E

634.62-1.462

Soil disinfection as a means of combating decline disease in date palms.

Reprinted from the 12th annu. Rep. Date Growers Inst., held in Coachella Valley, April 13th, 1935, pp. 7, bibl. 16.

Considerable evidence has been accumulated which indicates that the cause of decline disease of date palms is a soil fungus, identified tentatively as a species of *Omphalia*. The distribution of the fungus in the root system was studied in a stunted 9-year-old Deglet Noor palm. The concentration of *Omphalia* sp. was found to be greatest about the base of the trunk in the upper 2 feet of soil, while at a depth of 4 feet it was comparatively rare. Experiments with chemical soil treatments showed that copper sulphate was ineffective against *Omphalia* sp. and at the same time gave rise to chemical injury, and that heavy applications of materials containing available nitrogen, phosphorus, and potassium resulted in approximately 2½ times as many diseased plants as did the control. Chemical soil treatment trials were, therefore, temporarily abandoned and attention was turned to soil disinfectants. Of these carbon bisulphide and chloropicrin appeared to eradicate the fungus, but, as treatment with the latter is excessively expensive, the former is recommended for use. The method of applying carbon bisulphide to the soil after the removal and destruction of a diseased palm is described. It acts quickly and escapes from the soil as a gas, after which replanting can be done without risk of injury. Disadvantages are the inflammable nature of the chemical, and the present lack of a satisfactory implement for applying it.

395. PARHAM, M. A.

634.74 : 632.4

Wilt disease of yangona.*Agric. J. Fiji*, 1935, 8 : 2-8.

The cultivation of yangona (*Macropiper methysticum*), a beverage plant of Fiji, formerly used only for ceremonial purposes, has become fairly common in certain districts, since it has been found to produce a remunerative return. The yangona is a robust, somewhat succulent shrub attaining a height of about 10 ft. The underground portion of the plant is usually swollen, semi-woody to succulent, and gives off numerous lateral, fibrous roots. The most valuable parts of the plant are the thickened underground portions of stems and crown and lateral roots and rootlets. Other parts of the plant are sometimes used as adulterants. Six varieties have been recorded, but only five are now known. The most suitable site is new land on a well drained hillside having a blackish soil supporting a fairly heavy jungle vegetation. The crop takes from 2½-4 years to mature, according to whether it is the reputedly inferior black variety (planted chiefly by Indians who want a quick return), or the white variety which produces the best yangona. Two successive crops cannot profitably be taken off the same land and a three years fallowing is said to give good results. Propagation is by sets or nodes, which in commerce are planted direct into the field and shaded with a tuft of grass but, if grown by Fijians, are first raised in nurseries. Profits over the four-year period would be about £400-£500 on a 10 acre holding, presuming the labour to be supplied by the owner's family. During the last two years a destructive disease, the exact nature of which has not yet been determined, has done considerable damage and is increasing. It is manifested by a collapse of the stem and definite wilting in young plants and in old ones by a dying back of the stems from the apex. These conditions are secondary to an infection of the root and crown which causes extensive decay. Control measures should consist in the compulsory eradication of diseased areas prior to abandonment, the roguing of diseased plants from all plantations and the selection of planting material from healthy stands only. Government supervision is advised, as there is every indication that the disease is a major one.

396. EASTWOOD, H. W.

634.771

Contour planting of bananas.*Agric. Gaz. N.S.W.*, 1935, 46 : 693-6 and 1936, 47 : 35-8.

Bananas are frequently grown on hillsides, and the advantages of planting them on contours rather than in regular square or hexagonal formation are: (1) better control of surface soil erosion, (2) better exposure to sunlight, by avoiding plants shading one another, (3) easier and cheaper for cultural and other operations. Against these the main objection is the more costly layout, but it is held that the advantages would ultimately far outweigh this disadvantage. The fact that the rows will not be parallel is not usually important, because labour is nearly all manual, and under any system of planting the rows ultimately get out of alignment. The plotting of contour lines on hilly, uneven country is described with the aid of diagrams. Finally it is noted that contour planting in new banana areas would provide a sound basis on which to tackle the problem of soil erosion.

397. MAGEE, C. J.

634.771-2.8

Bunchy top disease of bananas. Rehabilitation of the banana industry in New South Wales.*J. Aust. Inst. agric. Sci.*, 1936, 2 : 13-6.

Bunchy top disease of bananas is a virus disease carried by the banana aphid, *Pentalonia nigronervosa*. The paper describes how the banana industry of New South Wales, brought to ruin by 1925 by the attacks of this disease, was rehabilitated by 1935 by field control methods carried out under government supervision assisted by growers' organizations. Control was rendered easier by the fact that the virus had a narrow host range and the vector limited feeding habits. The methods adopted involved registration of plantations, eradication of diseased plants and controlled replanting with known disease-free plants. Although these methods were successful in suppressing the disease, nevertheless constant watchfulness, particularly

in observing and destroying diseased plants, is still necessary. This is proved by an increased incidence of the disease which has accompanied a fall in prices and the consequent reduction of labour costs, largely due to over production following the success of the control measures.

398. ANON.

634.771-1.56

The endless wire system for banana plantations.

Qd. agric. J., 1936, 45 : 63-7.

The transport of banana bunches, and for that matter of any other fruit grown on hillsides, to the packing shed may be greatly facilitated by means of an endless wire system. The fruit is despatched from a central point in the plantation on carriers which run on wires, and, as the loaded carrier proceeds downhill, a second carrier is automatically returned uphill for another load. In this article the construction of the system and of the carriers is described with the aid of diagrams.

399. EASTWOOD, H. W.

634.771-2.4

Destruction of banana plants. Experiments prove that oils are too costly.

Agric. Gaz. N.S.W., 1936, 47 : 193-9.

The experiments were undertaken to discover, if possible, a less expensive and laborious method of destroying banana plants condemned for any reason, than the method of digging and cutting up now enforceable under the Plant Diseases Act in New South Wales. The trials were made on 25 stools and the standard methods of preparing the stools and the application of the oil as described by Smith (*Trop. Agriculture, Trin.*, 1932, 9 : 83-6) were closely followed. Out of the 16 stools treated only 5 gave promising results. The minimum cost of the successful treatments for labour and oil was £5 10s. per acre, whereas the cost of the present digging and cutting up method is from £4-£5 per acre and the results are more certain. The results with oils are best when contact is made with corms, suckers and eyes and growing corms with active tissues. Solid corms hidden under the soil are liable to be missed while inactive ones are purposely left untreated to save the oil. Both these classes invariably produce fresh growth. Contrary to the experiences in Jamaica and Ceylon (Park., *Trop. Agriculturist*, 1933, 81 : 86-90) lighter oils, power kerosene and light gas oils were rather more successful than heavy Diesel oils.

400. DUTHIE, J.

634.774

Pineapple growing in Hawaiian islands.

Qd. agric. J., 1936, 45 : 182-6.

Approximately 93,000 acres in five Hawaiian islands are devoted to pineapple production. Rainfall varies from 10 to 100 inches, averaging about 50 inches. Temperature varies between 70 and 90°F. Pineapples are grown between 900 and 3,000 feet above sea level. All the soil is red, volcanic and sticky when wet, and, although it may contain up to 40% iron, the presence of manganese prevents the plants utilizing this supply. Planting is mainly done on the two row system, and a border line of say 20 feet with a 10 feet road between it and the main plot is used to give indication of the arrival of pests, particularly the mealy bug. All pineapples are grown with the aid of paper mulch, the mulch being run out by a machine. In planting, slips or nibs are used, if available, and these are fumigated, if necessary, before planting. With one main crop and two ratoons the cycle lasts 4-5 years. Potash and phosphates are not usually deficient, and the principal fertilizing is with sulphate of ammonia, applied through the axils of the basal leaves on account of the paper mulch. Sulphate of iron, 25 lb. in 100 gals. water, is applied as a spray to counteract the effect of excess manganese in the soil. Short notes are also supplied on grading and trimming, crates, pests and diseases, spraying, and plant selection. From his observations the author considers that Queensland pineapple growers would do well to pay attention to plant selection and the fumigation or dipping of all planting material. They should also imitate more closely the Hawaiian method of close planting, should adopt the practice of using quick-acting chemical fertilizers, and, where manganese chlorosis occurs, should spray with sulphate of iron and sulphate of ammonia.

401. FOLLETT-SMITH, R. R., AND BOURNE, C. L. C. 634.774-1.8
The uptake of minerals by pineapple plants at different stages of growth.
Agric. J. Brit. Guiana, 1936, 7: 17-20.

The experiments were carried out by the Department of Agriculture to provide information as to pineapple plant behaviour on Wallaba sand, a soil consisting of coarse, white, quartz sand containing 98% of silica and 2% of organic matter. The commercial pineapple Smooth Cayenne was used and the experimental plants were grown in tubs, precaution being taken to obtain as complete uniformity of material as possible. The experiment lasted 18 months and was then concluded, owing to attacks by rodents, before the fruit was fully mature. Frequent samplings were made throughout the duration of the experiment. The following conclusions were drawn. During the first six months only a small amount of potash (7.3% of the total amount) is absorbed, but thereafter the uptake is rapid and continuous. With nitrogen 10.3% of the total is absorbed during the first 6 months, none is taken up during the 3 months before flowering and there is a considerable uptake during the fruiting period. Phosphate uptake closely resembles that of nitrogen. Appreciable amounts of lime and magnesia are also absorbed but not until after the first 6 months. It is recognized that plant ash analyses do not always give reliable indications regarding manurial requirements, but the data presented here suggest that a mixed fertilizer of nitrogen, phosphate and potash might be applied when the plants have made 6 months of growth.

402. RUSSELL, T. A. 635.64: 632.4/7
Diseases and pests of tomatoes in Bermuda.
Trop. Agriculture, Trin., 1936, 13: 71-7, bibl. 17.

The diseases and pests attacking the tomato crop in Bermuda are described. They resemble those of North America rather than those of the West Indies. Fungus diseases attacking the base of the plant are:—Fusarium wilt (*F. Lycopersici* Sacc.); attacking stem and leaf—blight (*Septoria Lycopersici* Speg.), sclerotinia rot (*Sclerotinia sclerotiorum* (Lib.) de Bary) and leaf mould (*Cladosporium fulvum* Cke.); attacking the fruit—brown rot (*Rhizoctonia Solani* Kuhn), phoma rot (*Phoma destructiva* (Plowr) C.O. Jamieson) and phytophthora rot (*Phytophthora infestans* (Mont.) de Bary). Bacterial diseases affecting the fruits are bacterial speck of fruit (*Bacterium vesicatorium* Doidge) and leak or bacterial rot (*Bacillus aroideae* Towns) entering any wound on the fruit. Of insects the potato tuber moth (*Phthorimaea operculella*) may cause heavy loss in summer. The state of the weather has a powerful influence on the incidence and relative importance of the diseases and pests.

403. JULIANO, J. B. 633.492
Morphology of the sweet potato, *Ipomoea batatas* (Linn.) Poir.
Philipp. Agric., 1935, 23: 833-58, bibl. 31.

An account is given of the organography and the development of the gametophytes, fruit and seed of the sweet potato variety Samar Big Yellow.

404. SAN PEDRO, A. V. 635.1/7: 631.531
Influence of temperature and moisture on the viability of some vegetable seeds.
Philipp. Agric., 1936, 24: 649-55, bibl. 13.

The experiment was concerned with seeds which are imported to the Philippines from abroad at a somewhat high cost and with some grown locally. The maintenance of viability is of importance because of the cost of the seed. Seeds used were cabbage, carrot, lettuce, pechay (*Brassica cernua*), radish, sitao (*Vigna sesquipedalis*), Kentucky Wonder beans, egg-plant and tomato. The influence of storage temperature and moisture on the viability of the seeds was determined by storing different lots of seed at 0°, 10-13°, 20°, 27.5-28°C. with and without calcium chloride and testing their germinability at intervals. Temperature appeared to exert little influence on the viability when storage took place in a dry atmosphere, i.e. with calcium chloride over a period of 588 days, with the possible exception of cabbage which showed a slightly significant benefit from 0°C. Without calcium chloride differences were negligible at 162 days,

but after 312 days beans, egg-plant, lettuce and pechay all deteriorated in positive correlation with the degree of warmth. Seeds stored at similar temperatures with humidity as the variable factor show the greater influence of humidity. Tomato seeds were not affected by calcium chloride. It is recommended that with seeds for storage in moist climates moisture should be removed with calcium chloride, failing which the seeds should be thoroughly dried and hermetically sealed in suitable containers.

STORAGE.

405. COPISAROW, M. 581.13 : 664.84 + 664.85
The metabolism of fruit and vegetables in relation to their preservation.
J. Pomol., 1936, 14 : 9-18, bibl. 61.

The experiments recorded in this paper show :—(1) Maleic acid inhibits the processes of ripening and germination, as well as parasitic activity, in a variety of fruits and potatoes. This suppression of metabolic functions is temporary in character and does not appear to exert any injurious effect. Maleic acid is much more effective in an inert etherial oil than in an aqueous medium, in which it is apparently unstable under the experimental conditions employed. (2) Etherial extracts of apples, freed from the solvent and dissolved in inert esters, exert an inhibiting influence upon embryonic development and respiration of fruit and potatoes similar to maleic acid. (3) Co-ordinating (a) the chemical and physiological similarity between maleic acid and the natural inhibitor, (b) the succession of the inhibitor at the maturity stage by ethylene as an accelerator and (c) the constitutional link between maleic acid and the acid-fruit constituents, as well as its possible degradation to ethylene, it is not improbable that maleic acid is identical with the natural inhibitor "blastokolin", and the transition of this inhibitor into the accelerator is represented by the degradation of maleic acid into ethylene. This conception not only elucidates an important phase in fruit metabolism, but has a direct bearing on the problem of fruit and vegetable preservation. [Author's summary.]

406. MANN, C. W., AND COOPER, W. C. 664.85.31.037
Refrigeration of oranges in transit from California.
Tech. Bull. U.S. Dep. Agric., 505, 1936, pp. 87, bibl. 17, summarized in
Calif. Citrogr., 1936, 21 : 234, 272-3.

Twenty-nine refrigeration tests were made during 1928-33, during which temperature and icing records were obtained in 189 car loads of California oranges in transit to Chicago and New York. Sources of unwanted heat were mainly from the field heat of the load and heat leakage from outside the refrigerator car. Heat leakage was greater with pre-cooled than non-pre-cooled loads, because the lower temperature produced a greater difference between the outside air and fruit inside the car. High outside temperatures increased heat leakage compared with low outside temperatures even in cars protected with $2\frac{1}{2}$ " of insulation. A good circulation of air in the car will carry the heat leakage to the ice bunkers where it is absorbed by the ice meltage, but with excessive leakage the normal air current is not sufficient to carry all the heat and part of it is absorbed by the fruit. Lower temperatures were obtained in boxes with the bulge side placed against the side walls of the car than in boxes with the flat side so placed. With non-pre-cooled loads large temperature differences were noted between top and bottom of load in all positions, the differences tending to lessen during the latter part of the transit period. With non-pre-cooled oranges under standard refrigeration it took from 4 to 6 days to lower the top layer temperature below 50°F. An initial icing at the first icing station and two icings between California and New York of non-pre-cooled fruit gave refrigeration approximately equal to standard refrigeration in summer weather. The results obtained with pre-icing combined with different numbers and times of re-icing in transit are also given. Pre-cooling fruit in the cars with fans for 16 hours increased the rate of cooling and decreased temperature differences throughout the load below those of any method cited,

and the use of a pre-iced car was more effective than a dry car for this precooling. The most uniform and lowest temperatures in all these tests was afforded by car loads of warehouse pre-cooled fruit, pre-iced only. Precooling below 40°F. is of doubtful value, as the refrigerator cars cannot maintain a temperature below this. The results showed no significant relation between methods of refrigeration and spoilage, very little spoilage occurring in any of the experimental cars. These modified methods of refrigeration have been granted lower freight rates than those charged for the more costly standard methods of refrigeration and the change represents an annual saving to the citrus industry in excess of 1,000,000 dollars.

407. WARDLAW, C. W. 546.15 : 664.85.021

Iodine and the control of fungal wastage.

Trop. Agriculture, Trin., 1936, 13 : 117, bibl. 2.

It is shown that, while the use of iodized papers for wrapping fruit will result in the destruction of superficial spores and hyphae, the iodine vapour also exerts a harmful action on the plant tissue and thus tends to decrease resistance to invading organisms once they have gained an entrance to the tissues. Thus in Trinidad grapefruit, where an interval of 5 days elapses between picking and packing, the use of iodine wraps at this later stage actually promotes wastage. The greatest caution, therefore, must be exercised before the principle can be applied to fruit handled under commercial conditions.

PACKING, PROCESSING, FRUIT PRODUCTS.*

408. THOMAS, P. H. 634.11-1.564

Selecting, grading and packing of apples for overseas export.

Tasm. J. Agric., 1936, 7 (n.s.) : 11-5.

The general principles involved in the selection of suitable varieties, in picking, quality and colour grading, sizing, packing, labelling and stencilling, are discussed briefly.

409. MORRISON, W. W. 634.11-1.56

Physical handling of export fruits.

Proc. Wash. St. hort. Ass. for 1935, 1936, 31 : 34-7.

A brief account is given of a study undertaken at Seattle of the handling of apples for export. Damage has been found to occur through lack of care in unloading railroad cars and trucks, in handling cases on the wharves, and during stowage in ships. Directions in which improvements may be made are noted. Information from Europe shows that methods of handling fresh fruit at certain European ports are particularly detrimental. In an effort to encourage improvements at this end an outline of the progress being attempted at Seattle has been sent to some 500 importers in Great Britain and other European countries.

410. TISSOT, P. 633.74-1.56

La fermentation du cacao. (Cacao fermentation.)

Rev. Bot. appl., 1936, 16 : 264-75, bibl. 24.

The biological processes involved in the preparation of cacao by fermentation are discussed in considerable detail. The opinions of numerous workers in this field are cited.

411. GEORGI, C. D. V. 634.6 : 665.3

Boiler-feed water treatment in the palm oil factory.

Malay. agric. J., 1935, 23 : 568-79, bibl. 2.

The use of unsatisfactory boiler-feed waters and consequent difficulties in keeping the heating surface clean may result in wastage of heat and fuel, in heavy expenditure for repairs and renewals to the boiler, and in deterioration of the quality of the palm oil during periods when factory

* See also 255.

operations have to be suspended to dismantle the boiler. In this paper an account is given of a recent survey made of boiler-feed waters on the majority of palm oil estates in Malaya, and arising out of these findings treatments are described whereby boilers may be maintained in a satisfactory condition.

412. COOKE, F. C. 634.61 : 658.8
Copra manufacture.
Malay. agric. J., 1936, 24 : 167-76.

This is the first of a series of three articles dealing with the preparation of copra in kilns, in which the copra is heated directly by the hot gases of burning coconut shells. The kilns described are capable of producing a superior grade of crisp, white copra. Two kilns are described which are inexpensive to build and are suitable for use on small holdings of 1-30 acres.

413. JACK, H. W. 634.61 : 658.8
Brief notes on small copra driers.
Agric. J. Fiji, 1935, 8 : 8-11.

A useful description, accompanied by a diagram, of the method of construction and use of a small inexpensive copra drier which will ensure the production of evenly cured good quality copra. It is pointed out that sun drying is uncertain and that many copra driers are expensive and inefficient. The type here advocated is successfully used singly on small holdings or in groups on larger estates in Malaya and Ceylon.

414. LYNCH, L. J. 663.815
A preliminary report on methods for the preservation of orange juice.
J. Coun. sci. industr. Res., Aust., 1936, 9 : 29-36, bibl. 16.

In preserving orange juice the ideal is to obtain a product which after prolonged storage still closely resembles the fresh juice with respect to taste, flavour, aroma and colour. An account is given here of the changes due to living organisms, to enzymes, and to chemical reactions, which result in degradation of orange juice during processing. Commercial procedure used in the U.S.A. is outlined. It is noted that up to the point of pasteurization this process seems to be satisfactory, but from then onwards a great diversity of opinion exists with regard to the most suitable methods. These will have to be tested in Australia, as will the question of the variety of orange, for it is by no means certain that the Valencia is the most suitable type for a local industry. Encouraging results obtained in the U.S.A. from treating orange peel and pulp for stock food and for conversion into manures should also be tested in Australia. Finally a complete analysis of the minor constituents of the orange remains an urgent necessity.

415. McCUTCHEON, W. 664.85.87.047
The drying of sultanas. Recommended dips give best results.
Agric. Gaz. N.S.W., 1936, 47 : 161-2.

Formulae are given for three standard dips for sultana grapes as follows:—(1) The cold dip—water 100 gals., carbonate of potash 56 lb., olive oil 3 pints. The fruit is immersed for 2-4 minutes and it may be necessary to add a little more oil, if the wax bloom is not almost entirely removed during this period. The cold dip is recommended for use only in the hotter and drier areas. (2) The boiling caustic dip—2 lb. caustic soda to 50 gals. water. It is used at 212°F., and is particularly suitable where the fruit has been damaged before harvest. (3) The mixed dip—water 50 gals., carbonate of potash 2 lb., olive oil 1½ pints, caustic soda 2 lb. This is used at a mean temperature of 180°F. and combines most of the good points of both the cold and hot dips. Sufficient time should be allowed in dipping for the mixture to penetrate to the fruit in the centre of the buckets. Contrary to general practice the draining table is best set to slope away from the dipping tank. After reasonable draining the fruit is spread, not too thickly, on racks. While drying it should be protected from sun and rain, and during this period one or more sprayings with the cold dip mentioned above may be needed to hasten drying by renewing the oil film on the surface of the fruit. When the fruit is almost entirely dry it is shaken down

on to hessian, placed for preference on some waterproof material, where it is bleached in the sun to remove the green tinge. When the green colour is marked, spraying with water on removal from the racks will help to remove it.

416. KERTESZ, Z. I.

664.84.656

The chemical determination of the quality of canned green peas.

Téch. Bull. N.Y. St. agric. Exp. Sta., 233, 1935, pp. 26, bibl. 17.

In the present scoring and grading system used commonly in the U.S. for canned green peas the total of 100 points is divided as follows:—Tenderness and maturity 35, flavour 25, clearness of liquor 15, absence of defects 15, uniformity of size and colour 10. This is seen to be based largely on personal opinion, and is thus not reproducible. The determination of quality by an objective method would be of great advantage, and the study described here was undertaken with this in view. It was found that when scores for tenderness and maturity based on the standard method were plotted against scores for flavour and the averages of total scores they indicated linear relationships. Thus, since the present score used for tenderness and maturity is directly proportional to flavour and to the total score, it only becomes necessary to determine maturity by chemical means in order to estimate the quality objectively. A study was, therefore, made of the possible use of total solids, alcohol-insoluble solids and water-insoluble solids content of canned peas for the determination of maturity. Correlations were obtained in all cases, but for various reasons the alcohol-insoluble solids content is considered to be best suited to the evaluation of maturity and quality. Two grading systems are proposed in which use is made of the above findings. In the first the determination of alcohol-insoluble solids replaces the organoleptic evaluation of maturity plus tenderness, and in the second it replaces the evaluation of flavour as well as that of maturity and tenderness. Correlations between results obtained by these two chemical methods and by the standard method are shown and discussed.

417. TEMPANY, H. A., AND OLDS, G. D. P.

664.85.774

The application of the exhaust process in the Malayan pineapple canning industry.

Malay. agric. J., 1935, 23: 563-7, bibl. 3.

The Malayan pineapple canning industry is unique in that the cans are not subjected to any form of exhausting before sealing. It has been suggested that this has not proved essential, because the pineapples are sold almost entirely in temperate climates where the lower air temperatures obviate the risk of expansion of the air inside the cans. It is, however, thought that the introduction of an exhaust process would lead to packs of improved quality and to a reduction in spoilage. With this in view preliminary trials have been made with both cubes and slices. Samples were subjected to cold exhaust, whereby a partial vacuum was produced by a small exhaust pump, and to hot exhaust at 112°F. for 30 minutes. These and comparable non-exhausted samples were subsequently cooked and examined after cooling. The results indicate that both methods of exhausting produced improvements in colour, general appearance and flavour compared with controls, but that these were somewhat less marked in the hot exhausted than in the cold exhausted fruit. The deepening and improvement in colour is considered to be particularly significant, because it suggests that the proportion of Golden Quality to G.A.Q. quality fruit might be increased considerably by introducing an exhaust process.

418. PICKFORD, P. T. H.

663.3

Experiments on the improvement of the juice from culinary and dessert apples by maceration with pressed bittersweet pomace.*

J. Bath W.S.Co. Ass., 1935-6, 10 (ser. 6), 194-8.

It is shown by experiments that a considerable amount of the bittersweet character can be introduced with the juice obtained from market apples by re-pressing the latter with pressed

* For previous articles see *Ibidem.*, 1934-5, 9: 165-8, *H.A.*, 1935, 5: 2: 313.

bittersweet pomace. The quality of blend made from equal proportions of market apples and bittersweet cider apples can be improved to an appreciable extent by re-pressing the juice obtained from the market apples with unpressed bittersweet pomace. A cider of fair quality can be produced with one part of bittersweet cider apples to three parts of market apples by re-pressing the juice from the market apples with the bittersweet pomace. [Author's conclusions.]

419. BECKLEY, V. A.
Essential oils.

668.52

E. Afr. agric. J., 1936, 1: 302-4, 308.

This article is the first of a series dealing with essential oils based on the recent work on the subject at the Scott Agricultural Laboratories, Kenya. In this paper methods of distilling are discussed and various stills are described.

NOTES ON REPORTS.

420. MINISTRY OF AGRICULTURE, LONDON.
A selected and classified list of books on agriculture.
Bull. Minist. Agric., Lond., 78, 1935,* pp. 22.

016:63

This selected list of modern books in English, filed in the library of the Ministry of Agriculture, is arranged in groups according to subject matter, and appears to embrace all branches of agriculture in temperate regions. Persons interested in horticulture will find sections devoted to books on botany, flower growing, food preservation, fruit growing, fungicides, general horticulture, insecticides, irrigation, market gardening, vegetable growing, etc.

421. MINISTRY OF AGRICULTURE, LONDON, AND OTHERS.
Reports on the work of agricultural research institutes and on certain other agricultural investigations in the United Kingdom, 1933-1934, H.M. Stationery Office, London, 1936, pp. 351, 5s.

63(42)

This report follows the lines of previous issues. Section C, Horticulture and Glasshouse Crops, pp. 57-116, gives an outline of the investigational work in progress during 1933-4 at the following English research stations: Long Ashton, Bristol, under the principal headings—Fruit culture, Fruit preservation and products, and Willow culture and the utilization of willows; East Malling—Pomology, Physiology, Biochemistry, Plant Pathology, Entomology, Hops; Horticultural Research Station, Cambridge—Plant Breeding, Chemistry, Mycology, Entomology; Experimental and Research Station, Cheshunt—Glasshouse crops; John Innes Horticultural Institution, Merton, London—Genetics and cytology of plants. A list of papers issued during the year from each station is given. Investigations of horticultural interest done elsewhere are noted separately.

422. UGANDA.
Annu. Rep. Dep. Agric. Uganda for July 1934-June 1935, part II, 1936, pp. 99.

633.72 + 633.73 + 634.58

This section deals with the experimental work carried out by the Department and is full of interest. Although here it is only possible to give some selected significant results, the layouts and conditions of the various experiments noted are described in the report, as also are numerous experiments not yet brought to a conclusion. *Groundnuts*. Superiority in yield was shown by bunch over spreading types, mulched over non-mulched, 6" x 6" spacing over 9" x 9" and by 9" x 9" over 12" x 12". Mulching had no effect on spreading type. *Arabica coffee* at Bugusege. *Pruning Experiment*. Over the six seasons 1929-34, the descending order of yield of

* First edition 1934; reprinted, with amendments, 1935.

three methods is agobiada, multiple stem, single stem. *Manuring (cultural) experiment.* Yields of arabica under five cultural treatments in descending order over five seasons are clean weeded, banana mulch, one cover crop (March-October), two cover crops, weed cover. Banana mulch seems to prevent large fluctuations in yield from year to year. *Modified multiple stem pruning plus above treatments and one other, laid down in 1932.* In the first year one cover crop gave the highest yield of cherry. *Coffee at Bukulasa. Shade and ground treatment.* No shade and plantain shade plus clean weeding gave higher yields than permanent cover under similar conditions. The local opinion that coffee will eventually kill out its plantain shade seemed justified. *Ground cultural treatment.* Both clean weeding and elephant grass mulch resulted in much higher yields than permanent cover and weed cover for the first season's cropping. The weed cover yield was particularly poor. *Botanical work on coffee at Kampala. Self-pollination* gave the expected high percentage of success in arabica and an unexpected high percentage in robusta which workers in other countries have always reported as being of exceptionally low self-fertility. There was, however, a large proportion of pea berry (i.e. development of only one ovule). *Grafted coffee.* Contrary to what has been claimed in other countries the grafting of arabica on to strong growing stocks resulted in the grafted plants proving more and not less susceptible to leaf disease (*Hemileia vastatrix*). The sudden dying off of some of the most robust of the grafted coffee trees is attributed to incompatibility of stock and scion hindering the movement of carbohydrates down to the roots with the result that, if the tree is bearing a good crop, the roots have died of starvation. Facts are given in support of this hypothesis. *Cuttings.* Various types of cuttings set in a solar propagator and in frames callused and produced leaves but failed to root, with the occasional exception of cuttings made of the hardest wood on which the bark had started to crack. *Soil treatment and growth.* The maintenance of a cool soil by means of mulch or shade has proved most beneficial to growth. Mulch has fewer drawbacks than shade. With young seedlings, however, shade increased growth while mulch proved inefficient. *Tea.* Germination tests with tea seed showed that if floating seeds were discarded (the usual practice) most of the bad seeds would be removed, but also many would germinate, so that, if seed is scarce, the practice is wasteful. Batches of seed were collected and sown during February, May, August and November. There seemed to be a seasonal variation in percentage of germination which it is hoped to investigate.

423. MYSORE STATE.

634.11-1.541.11 : 634.771 + 634.441

Annu. Rep. Dep. Hort. Mysore State for 1933-4, 1935, pp. 58.

The following notes are abstracted from the report. *Experimental work on fruits.* A list of 52 varieties of apples under trial at Bangalore and in the experimental orchard at Krishnarajasa-gara is given. Four-year-old trees which have begun to fruit are Rome Beauty, Cox's Orange, Ribston and Sturmer Pippins, Red Rome, Loy, Lord Wolseley, Stayman Winesap, Red States-man and Cleopatra. The rootstocks are not mentioned, but it is stated elsewhere in the report that East Malling apple stocks are being acclimatized. The local method of propagation is by whip grafting, but experiments in root grafting are in progress. Root grafted plants are expected to resist sunscorch and collar rot. A banana variety called Madura Annan now under trial is producing a good quality fruit which has become very popular with the public. A great variety of fruits trees of various kinds, mainly tropical, is under trial. *Economic development work.* As a result of the Department's efforts in providing technical advice and in the selection of suitable lands a large number of fruit gardens have been started. About 16,000 acres are under mangoes and 18,500 acres under plantains. There is a good export trade with neighbouring States. There is, however, still a great quantity of foreign imported fruit to be seen competing with home-grown fruit in the market. A fruit research scheme has been drawn up and establishment of a research station is under consideration.

